THE ILLUMINATING ENGINEER

LIGHT
LAMPS
FITTINGS
AND
ILLUMINATION

THE JOURNAL OF

GOOD LIGHTING

Official Organ of the Illuminating Engineering Society

FOUNDED IN LONDON 1908

Edited by
J. STEWART DOW

OIL
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ACETYLENE
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THE GAS LIGHT & COKE COMPANY, HORSEFERRY ROAD, WESTMINSTER, S.W.1

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The Illuminating Engineering Society

ARTICLES AND BY-LAWS.

AN important step in the history of the Illuminating Engineering Society was taken on July 9th, when, at a Special General Meeting, the draft Articles and By-laws were approved. It was gratifying to see present so many leading members of the Society, at a meeting necessarily held during the summer season, when good attendances are not usually easy to secure. The readiness with which the draft was accepted is a tribute to the sound work of the Committee responsible for the drafting, and especially to the sagacious guidance of the President, Mr. C. C. Paterson. In the main, only minor modifications were suggested. The one point on which some little difference of opinion seemed to exist was the practice of making retirement of members of Council obligatory after three years of service. Everyone appreciated the fact that the practice has drawbacks as well as advantages. It may sometimes be regrettable to lose the services of a useful member—though it will be observed that the by-laws would permit his return to the Council after only one year's absence. On the other hand, there is the advantage that the practice makes quite certain the introduction of new blood at regular intervals, and thus offers opportunities to all active members of the Society of sharing in the work of its Council. The fact that Past Presidents will continue to serve on the Council should have a steadying influence; their experience will be added to the enthusiasm of new and younger entrants.

The way is now clear to the next step, the procedure of securing incorporation, in which the help of legal experts will be necessary. This step is one which all societies of standing ultimately take. Until a society has a charter or is registered as an incorporated body it has no legal existence. Incorporation is the first step. A charter may follow eventually. In the meantime it will be a distinct advantage to the Society to have its procedure explicitly outlined in the same manner as other bodies.

So far as one can foresee, consent from the Board of Trade to incorporation should not present any great difficulties, especially as the Society is not seeking professional status, but at present only seeks recognition as a body devoted to the study of illumination, which anyone interested in the cause of "better lighting" is free to join.

Glare and Visibility in Artificially Lighted Streets

IN this number (pp. 197-201) we are commencing a contribution from Mr. Stiles dealing with the tests on glare and visibility in artificially lighted streets, conducted in connection with the annual conference of the Association of Public Lighting Engineers in Sheffield last year. Many visitors to Sheffield took part in these tests, which were protracted into the small hours of the night, and the summary of results has been looked forward to with some curiosity. The analysis of the tests is somewhat comprehensive, and the contribution will extend over several issues of our journal. Mr. Stiles, however, has kindly drafted an abstract mentioning the chief conclusions arrived at, which appears under the title on p. 197.

It is interesting to observe that, on the whole, degree of visibility and avoidance of glare go together; i.e., there were apparently few installations which were glaring and yet gave good results from the standpoint of visibility. The tests apparently support the impression, which was emphasized in Mr. Colquhoun's Presidential Address at Sheffield, that the limiting glare factor in the British Standard Specification is too low. Thus the demonstrations have had already one useful effect in drawing attention to a possible improvement in the specification. It is somewhat curious to find that observers, in their judgment of glare, seem to have been chiefly influenced by the impression received from the nearest lighting unit rather than the appearance of the street as a whole. It is evident, however, that the problem of defining glare is not a very easy one. Discomfort and decrease in visual power may be distinct items. It also seems possible that there are some effects of glaring lamps which would need other special tests for their detection; one might mention, for example, the "distracting effect" of bright lights on the driver of a motor vehicle. It is conceivable that a distant light, or one seen "out of the tail of the eye," might be influential in this respect, though causing little discomfort, and we are also inclined to think that intrinsic brightness rather than candle-power might here prove to be the dominant factor.

All such investigations are rendered difficult by the personal factor. It would seem that eyes differ greatly in regard to susceptibility to glare, but it is one of the useful effects of these inquiries that people taking part in them are led to realize for the first time how troublesome effects of glare may be.

Light and Beauty

IT has recently been remarked that illuminating engineering is entering upon a new phase. Originally, when artificial light was expensive and meagre, engineers were concerned mainly with *the lamp*, the appliance for getting light, without considering very deeply how this light was used. At that time it was not usually assumed that consumers could benefit by using more light. The tendency was to assume that any advance in the efficiency of light production was useful mainly in enabling them to get the same amount of light at a lower cost. The claim usually pressed for a novelty was that it "reduced the lighting bill."

With greater facility in methods of producing artificial light came a recognition that much might be gained by its scientific application. This in turn involved a knowledge of the measurement of light, so that for a time experts were concerned mainly with numerical data and calculations, and installations were judged mainly in terms of "efficiency," defined in a somewhat narrow sense.

Even at a somewhat later stage, when the needs of the eye came to be more fully recognized, and it was appreciated that such phenomena as "glare" and "contrast" were quite as important as the numerical value of the illumination provided, the view being taken of the functions of artificial light was still mainly utilitarian. Efforts were made to show that in the home and the school good lighting was essential in the interests of comfort, cleanliness and preservation of vision; that in the factory good lighting, by promoting more efficient production, "paid for itself." This method of regarding illumination marked a distinct advance. It was no longer necessary to assure people who were actually using far less light than was expedient that they could reduce their bills. The idea that poor lighting is dear at any price has gained acceptance, and already the general standard of illumination has advanced considerably beyond that of only ten years ago.

Illuminating engineers are so conscious of the many examples of inadequate lighting around them that it is still necessary to press this utilitarian aspect. Indeed, it will probably continue to be essential to do so for many years to come. Yet there are already signs that a new stage is being approached. The greater abundance of artificial light and the more enlightened view taken by the public of the value of good illumination are paving the way for a fuller conception of the possibilities of light as a decorative medium and as an aid to beauty. That such a movement is needed few can doubt. The very facility in producing and applying artificial light has its dangers. Even if the cruder mistakes—such as the exhibit of glaring unscreened sources of great brightness—are avoided, the discriminative use of light for utilitarian objects may be unsightly. Light, like any other art, may be unduly commercialized.

In the movement towards what is known as "architectural lighting" we have something with great possibilities. Yet even this development has its dangers. The fundamental idea of making lighting appliances an integral part of the architectural scheme is sound. In some of the latest installations in large offices, public buildings and cathedrals we have already evidence that artificial lighting is attaining its true status as an art. But this new mode of lighting, naturally enough, finds its readiest application in the service of caterers and entertainers, who, as a class, derive the most immediate return, and have the greatest inducement to be generous in the use of artificial light. Hence this form of lighting may become unduly commercialized, and there may be a temptation to "strive for effect." As Mr. Gordon Selfridge recently remarked, some Continental examples of "architectural lighting" seem unduly eccentric; whilst we should not be afraid of experimenting with new ideas, there is sometimes a tendency to aim at originality for its own sake.

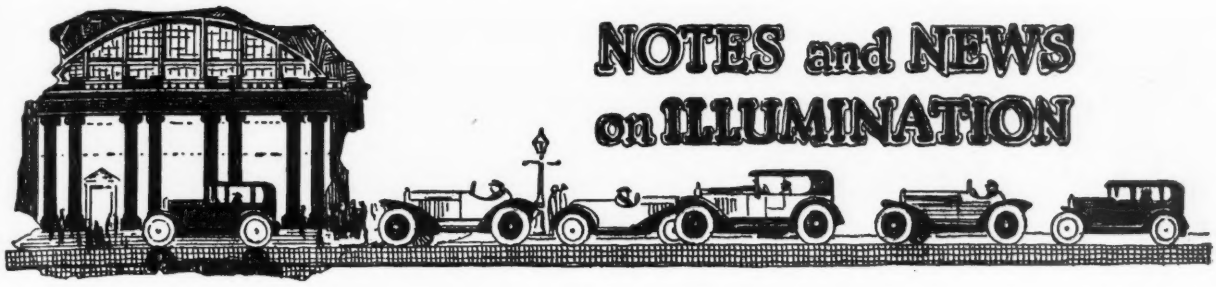
When applied for purposes of advertising and publicity, light itself is apt to become the centre of interest. But in the case of buildings of architectural distinction the light should be unobtrusive: it should blend with the architecture. One of the greatest services it can render is to serve as the handmaid of architecture. Illuminating engineers, if they so regard it, will already be well on the way towards securing the goodwill of the architect in this field of work.

So far we have spoken mainly of interior lighting. It is, however, in the field of exterior lighting that the greatest danger of the misuse of light, in the æsthetic sense, exists. It will be conceded that, however necessary the adequate lighting of our streets may be, the standards and lanterns furnishing this illumination are not, in general, works of art. It is true that in this field the lighting expert works at a great disadvantage. He has to work to limitations imposed by severe economy; he has often to endeavour to obtain approximately uniform illumination with standards spaced too far apart. From motives of economy, again, he must usually concentrate the greater part of the light flux on the roadway, leaving adjacent buildings in relative obscurity. Small wonder if, in achieving utilitarian objects, he fails to satisfy æsthetic needs. Floodlighting, by relieving the contrast between the bright public lamps and the adjacent obscurity, is a most useful weapon, and many pleasing examples exist. Yet even here the illuminating engineer works under disadvantages, for he is greatly limited in selecting the sites of projectors, and he has to deal with frontages of buildings designed without any regard to their being illuminated artificially.

We hope that in time to come public authorities will come to appreciate better the possibilities of floodlighting in rendering their city beautiful by night, so that it will no longer be applied exclusively for purposes of advertisement. In many other directions a genuine interest in the appearance of our streets by night would yield good fruit. Luminous signs, even more than floodlighting, are regarded at present as essentially advertising devices. No doubt more restraint is used by designers of these signs than in some other countries; yet there is a perpetual conflict of outlook between the advertiser and members of the public fearful of offences against good taste.

In yet another direction commercial and utilitarian applications of light tend to become unsightly—we refer to luminous devices necessitated by the continual growth of motor traffic. Light may do good service in assisting the traffic control. Yet we do not wish all our roads to resemble railway lines at night. Petrol stations and garages may make legitimate use of light to attract custom; but one cannot say that these are pleasing nocturnal effects. The illuminated advertisement, inevitable in our cities, seems likely to become prevalent even on country roads.

Doubtless we shall be told that all these tendencies are inevitable in a mechanical age. Yet we cannot help feeling that an appropriately constituted central body, acting as the guardian of the public interests, could do much to avoid "luminous eyesores," and that, by skill and foresight, practical and æsthetic requirements might be in a measure reconciled.



The National Physical Laboratory

REPORT FOR 1928.

The report of the National Physical Laboratory for 1928, as usual, covers a very wide ground and illustrates how much useful work has now been done at Teddington. Of special interest is the account of the researches in illumination and photometry; some of the chief investigations on daylight, glare, visibility, light wells, etc., were referred to in our last issue. Another interesting device is the apparatus designed for testing the red reflectors attached to cycles in order to make sure that these comply with the regulations of the Ministry of Transport. During the year 200 types have been examined and of these 50 were granted certificates. At the National Physical Laboratory much attention has been devoted to photo-electric cells, and the construction of a specially large type for the purpose of recording daylight is contemplated. Daylight recording by photo-electric means has, however, already been proceeding steadily. The report also contains an account of a new form of illumination photometer specially developed for high precision, and an account of problems involved in the use of photometric integrators. It is useful to learn that in such work the light sources should preferably not be distant more than 30 per cent. of the radius (or of the semi-side) from the central position. Work in connection with the international comparison of light standards has been proceeding steadily, and experiments on gasfilled lamps as standards are still going on. Evidently the problem of securing maintenance of exact conditions in such lamps is still proving rather difficult, though we believe that the various small sources of uncertainty are gradually being removed. Photo-electrical methods proved useful for observing small changes in candle-power during these investigations. In addition to all this experimental work the National Physical Laboratory continues to take a direct interest in the international aspects of illumination. Mr. Buckley has continued to act as Secretary of the National Illumination Committee of Great Britain, and Mr. W. S. Stiles has been appointed Secretary of the International Commission on Illumination.

Luminous Traffic Control

We understand that there is a likelihood of automatic luminous control of street traffic being tried out in this country on an extensive scale very shortly. Installations based on the usual exhibit of red, yellow and green lights, to indicate respectively "Stop," "Get Ready," "Proceed," appear to have worked very well in some of the provincial cities, though the method has only been experimented with on a small scale in London. We imagine there are many street corners, even in London, where a completely automatic control system of this kind might answer quite well. On the other hand, it would seem that the method has to be applied with discretion. A correspondent from Berlin tells us that automatic luminous signals are used at frequent intervals througout the length of the Leipzigerstrasse, and he thinks that the method is somewhat overdone. At any rate traffic is not infrequently brought to a stop by the automatic mechanism when there is almost a clear road—with the result that drivers are inclined to disregard the signal unless a police officer is present to enforce it. We still believe that there are great possibilities in the luminous control of street traffic, but each city may have to apply the method in a different way according to its local conditions.

Simplified Photometry

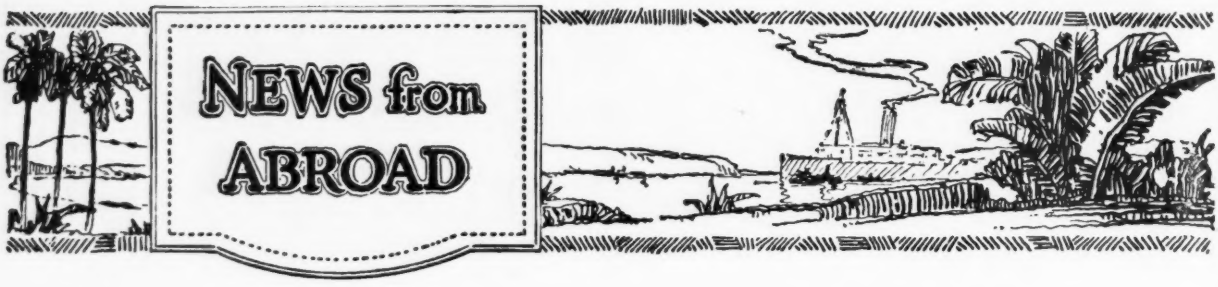
A visit to any well-equipped photometrical laboratory of the present day serves to show how much has been done to simplify procedure in photometry and avoid the somewhat tedious details which were usually a feature in the past. During a visit to the research laboratories of the General Electric Company at Wembley the author was struck by the number of ingenious devices to avoid calculations and reduce routine work to a minimum. Thus apparatus worked by compressed air served to move into position the lamps in the photometric integrator. In some cases rotating sector-discs take the place of the photometric bench, leading to a considerable saving in space. We notice also an ingenious arrangement whereby a single observer can read the photometer and manipulate the mirrors to obtain the polar curves of lighting units. We understand that photometric cells are proving quite a useful adjunct in the laboratory, and are now being applied to the routine testing of lamps as well as for special experimental work. There can be no question that this method should help to reduce the fatigue involved in taking photometric observations all day long, and it appears that, provided suitable precautions are taken, the method is as reliable as the use of ordinary photometric methods. This experience leads one to hope that ultimately portable photometers based on the use of the photometric cell may be evolved, but we may have to wait some time for this development.

Brighter Gasometers

We notice that, according to a recent correspondent of *The Times*, efforts have been made in Italy to render gasometers less conspicuous. In the vicinity of Naples and Pompeii can be seen a small gasholder on which ingenious experiments with camouflaging have been made. On the surface there appears a house, a piece of sky, a tree, etc. Though the idea may seem somewhat strange it is said that it answers quite well in practice. In the case of a large gasometer in this country considerable skill would no doubt be necessary, but the services of artists might be obtained to get the conditions best suited to the neighbourhood in which the gasometer appears. The idea is of special interest in view of the possibility that appearance from above may become more important in the future, when sightseeing by aeroplane becomes more usual.

Ultra-Violet Rays in Rubber Manufacture

It is well known that ultra violet radiation has a marked photo-chemical effect. The photo-chemical reactions induced by exposure to ultra-violet light include the fading of dyestuffs, darkening of various pigments, and the rapid oxidation of rubber, which is often revealed by the appearance of a large number of minute cracks on the surface of the sample. By the aid of a fadeometer the fastness of colours can be tested in a much shorter time than would be necessary by exposure to natural light. According to the *Electrical Review* the same idea is being tried in the rubber industry. Accelerated ageing tests with ultra-violet radiation are carried out in the laboratory to determine the comparative resistance of various rubber compounds, including those loaded with such pigments as lithopone.



Public Lighting in Cologne

A Novel Installation.

A correspondent who has recently returned from Germany tells us that the public lighting of Cologne has recently been completely remodelled, and that a great improvement has been made. The main lighting is now by means of centrally suspended units, which are mounted with the exceptionally small spacing ratio of only three to one. The fittings are of somewhat unusual design, one of the chief features being the use of a ring of diffusing glass underneath the metal reflector with a view to avoiding glare. Each fitting contains two lamps, one of which is switched off at certain hours when the busy traffic is over. It was explained that the switching-off of the two lamps does not render the appearance of the fitting unsightly; in this respect the diffusing action of the glass ring has a useful effect. The wires spanning the streets are attached to brackets on the walls of buildings, so that lamp posts are eliminated. In this country such methods can usually only be adopted after protracted negotiations, but in Continental cities the authorities are apparently armed with powers which enable them to make use of the surfaces of buildings in the public interest.

Street Lighting Statistics for American Cities

In the *Electrical World*, Mr. Otto P. Ortlied summarizes the results of a recent enquiry covering 224 American cities having a population of over 30,000. In 1923, 212 cities reported an average expenditure of 0.896 dollars per capita. From the data now obtained it appears that the average cost per capita increased to 4.2 per cent. each year during the past five years. In 1928 the average figure is 1.10 dollars per capita. This figure is approximately the same as that recently given by Mr. J. F. Colquhoun for the city of Leeds, but is more than the expenditure in Manchester and Sheffield. Reports from 224 cities circularized indicated that at present 11 cities are planning a large increase, 89 a moderate increase, 76 a small increase and 11 are not planning any change. Ten cities, amongst which Albany, Cambridge, Schenectady and Detroit are mentioned, will make large expenditures for street lighting in the near future.

The Second World Conference

We learn that the second World Conference is to take place in Berlin in 1930, and papers and suggestions for topics to be discussed are now being invited. As a help to authors a series of topics bearing on applications of gas and electricity is presented. This certainly includes many interesting items, and covers a wide ground. One's only criticism might be that at present illumination does not figure very prominently in the list, though we notice that papers are invited on "Illumination and Electric Signs as Factors in the Sale of Electricity." We hope that representatives of both gas and electricity will see that lighting is not overlooked. In spite of the rapid development of other uses of gas and electricity we should remember that artificial light still remains the most indispensable gift that both can offer, and that its applications were never of greater importance than they are to-day.

Signs of the Times

We notice that a contributor to *Signs* has recently been paying a visit to Paris and contrasts the illuminated signs in that city with those in London. He remarks that Paris does not go in for solidity in construction, "it does not build its signs as though the strength of a battleship were necessary." On the other hand, he has the impression that the signs in Paris are more gay, novel and striking, and, generally speaking, more enterprise is shown. In most cases in this country cheapness enters prominently into the contract. As a rule an advertiser will not trust the designer to work out a complete scheme. He will see a certain type of thing already in existence and will ask, "How much will that cost?" It would probably be much better if he would say, "Here is £100 (or £200 as the case may be)—what can you do for that? I will leave it to you to develop a scheme appropriate to the district and my shop front." The following conclusions by the author are worthy of study:—

1. That advertising in a brilliant way is far to be preferred to the dull and dead style.
2. That steady, continuous lighting scores over the jerky, intermittent type.
3. That cheapness is not always the first thing to be considered.
4. That the greater the demand for a style of lighting the cheaper should it become. At present the tubular lighting is but in its early days "relatively," but the time is coming when we shall see it "telling the tale" in every street of any size.

Regulations for the Lighting of Vehicles in Italy

According to *Illuminotecnica* the Italian Ministry of Communications has issued, after consultation with the Department of Public Works, an ordinance regarding registration-plate illumination. This is applicable to all motor-power propelled vehicles that are used exclusively for the transport of goods or which belong to regularly authorized services running on temporary roads, owners being obliged, unless they wish to become involved in the payment of penalties, to illuminate the registration plate, which has to be of the dimensions and style previously prescribed for the purpose, by electric lamps. The proprietors of vehicles have to provide a white light falling on the designation plate either from one lamp placed somewhat above the plate and shielded towards the outside or by two small lamps at its extremities. In either arrangement the intensity of illumination must be ample to enable the individual figures and letters to be legible at a distance of 30 metres. The obligation to maintain a red protection light towards the rear of the vehicle remains unaltered. The military authorities are compelled by the same edict to adopt similar illumination devices to all motor-driven transport vehicles, whether lorries, armoured cars, tractors, trailers, etc. This regulation also applies to motor cycles on military duty, which, however, need only be provided with one lamp that must, however, both illuminate the plate and project a red beam towards the rear.

TECHNICAL SECTION

COMPRISING

Transactions of The Illuminating Engineering Society and Special Articles

The Illuminating Engineering Society is not, as a body, responsible for the opinions expressed by individual authors or speakers.

Draft Articles and By-laws of The Illuminating Engineering Society

(*Proceedings at the Special General Meeting of the Illuminating Engineering Society, held at the House of the Royal Society of Arts, 18, John Street, Adelphi, London, W.C., at 6-30 p.m. on Tuesday, July 9th,* 1929.)

A SPECIAL General Meeting of the Illuminating Engineering Society was held at the House of the Royal Society of Arts (18, John Street, Adelphi, London, W.C.) at 6-30 p.m., on Tuesday, July 9th, the President (Mr. Clifford C. Paterson) in the chair.

The PRESIDENT, in opening the proceedings, called upon the Hon. Secretary to read the notice convening the meeting, which was as follows: —

"Your attendance is invited to a Special General Meeting, to be held at the House of the Royal Society of Arts (18, John Street, Adelphi, London, W.C.) at 6-30 p.m., on Tuesday, July 9th, 1929, for the purpose of considering the accompanying draft Articles of Association and By-laws which are issued with the approval of the Council.

"After the discussion a resolution will be moved approving the adoption of these Articles and By-laws, subject to any amendments adopted at the meeting, and the placing of these in the hand of legal experts so that they may serve as a basis for incorporation.

"It is hoped that all members will make a special effort to attend."

The President explained that the Council had spent a good deal of time and thought on the draft. It would be recalled that a few months ago, in order that the elections might be carried out under the most approved regulations, members had agreed in general principle and, to some extent, in detail to the relevant By-laws.

The Society and the Council were not pioneers in the drafting of Articles. They had had the advantage of examining the Articles and By-laws of other learned societies and had sought to adapt the best of them to their own needs. The document before members followed closely the wording of similar documents applicable to other societies. The draft had been circulated and, so far as he could learn, had been carefully and thoroughly studied. He would suggest that it should be taken page by page.

This course having been agreed to, Mr. W. R. RAWLINGS, after congratulating those responsible for the draft, moved the omission of the words in paragraph 3, page 1: "the theory and practice of." He thought that they were redundant and that their removal would leave the Articles broader than they would otherwise be.

Mr. J. ECK seconded. He thought the suggestion a very happy one.

The PRESIDENT agreed. The omission, while broadening the Articles, would not seriously detract from them.

On being put to the meeting this amendment was carried *nem. con.*

Mr. W. R. RAWLINGS then proposed the substitution of "one per cent. above bank rate" for "five per cent." in paragraph 4. He thought that there might be difficulty if the five per cent. was retained, and that what he proposed would meet the case of fluctuation.

Mr. J. ECK seconded this amendment, which was also accepted.

The HON. SECRETARY referred to one or two points that had been raised in correspondence. So far as the Articles were concerned the only point of moment was the suggestion that the Society might be somewhat tied down by paragraph 4, relating to application of income. He thought, however, that some such clause was necessary when seeking incorporation, and in the preceding clauses they had tried to make the "objects" of the Society as wide as possible. Other minor points and clerical errors were mentioned by Mr. A. BLOK, Mr. K. J. MACKENTIRE, and Mr. J. ECK. The PRESIDENT intimated that casual errors of wording would be corrected, and that on other points the opinion of the legal advisers would be taken.

Mr. W. R. RAWLINGS then moved "That the Articles, as amended, be accepted." This resolution was seconded by Mr. H. T. YOUNG, and was passed unanimously.

The meeting then passed on to the consideration of the By-laws.

Some discussion was initiated by Mr. H. T. YOUNG regarding the wording of paragraph 6a and it was ultimately agreed that this should read: "is over the age of 16 years but under the age of 21 years, and who is or has been pursuing a course of appropriate technical instruction at a recognized institution."

On the suggestion of Mr. Young it was agreed that the words "have rendered or" should be inserted before "may" in clause 9; so that past services as well as prospective services might be recognized. This proposal was accepted.

Mr. J. ECK, in connection with paragraph 7, suggested that the position of country members was not quite clear in the event of a branch being formed in their locality. The HON. SECRETARY thought that this point was made clear by paragraph 67, but, on the proposition of the PRESIDENT, it was agreed that the exact wording of these clauses should be reconsidered when legal help was sought in obtaining the final draft.

The question of the number of honorary members, referred to in clause 18, was next raised. Several members expressed the view that it was inexpedient that the number of honorary members should be limited to three, and it was finally agreed that the number should be increased to six.

The PRESIDENT then referred to a letter from Mr. F. W. Goodenough, who suggested that the decisions of the Council under paragraph 29 ought to be subsequently confirmed by a general meeting. The clause,

however, was intended to meet such cases as that of a member of long standing who had fallen on evil days and could not afford the subscription. The Council might feel that it would be an honour in such a special case to allow such a man to retain his membership. It was true that in this case, as in others, there was a possibility of abuse, but it was necessary to trust the Council. He thought, however, that it might be expedient to omit the words "life composition," and he would move this alteration from the chair.

Members having expressed their assent, Mr. L. E. BUCKELL drew attention to paragraph 32. He did not see why a member should be debarred from making more than one nomination at the same election.

The HON. SECRETARY explained that this condition, which found a place in the procedure of other societies, was intended to prevent ten people jointly agreeing amongst themselves to nominate each other in succession.

After some discussion the meeting endorsed the view of the President that this paragraph should be left unaltered.

Dr. J. W. T. WALSH said that he had been requested by a member to submit the suggestion that the words "The Past Presidents" under "Constitution and Election of the Council" should be altered to "The immediate Past President." Mr. L. E. BUCKELL suggested that in the course of time the number of Past Presidents might become unduly large, and he accordingly seconded this proposal. Other members, however, remarked that this procedure had been found quite useful by other societies, and emphasized the fact that it was of great benefit to the Council to have the advice and experience of Past Presidents at their disposal. On being put to the vote this amendment was not carried, and it was accordingly decided that the paragraph should remain unaltered.

Mr. J. WYATT IFE, referring to the paragraph entitled "Ordinary Members of Council," suggested that retirement after three years of service should not be made obligatory. The Society might be more than eager to see a person re-elected, yet the rules might preclude it. This was admitted by other speakers, and it was recognized that the practice might have drawbacks. Nevertheless the general view of those present was that on the whole the arrangement was expedient in order to ensure "new blood," and it was accordingly decided to leave this practice unaltered. Mr. J. MACKENTIRE suggested that it might be possible to retain the services of a specially valuable member of Council by co-opting him.

Mr. J. WYATT IFE then suggested the inclusion of the words "The Hon. Treasurer" after "Vice-President," in the fourth line from the end of this paragraph, and this proposal was accepted.

On the proposition of Mr. L. E. BUCKELL it was agreed that the word "postal" should be inserted before "ballot" in the first line of the last paragraph of paragraph 32, and on the proposition of Mr. H. T. YOUNG that "journal" should be substituted for "organ" in paragraph 44. Finally, on the proposition of Mr. L. E. BUCKELL, it was agreed that "meeting" in paragraph 47 (*c*) should be in the plural.

There being no further suggestions, the PRESIDENT then moved:—

"That this meeting adopts these Articles and By-laws as now amended, and instructs the Council to seek incorporation of the Society on the basis of these Articles and By-laws; that this meeting authorizes the Council to engage legal advice in connection with the incorporation; that the Articles, as finally approved by the Board of Trade, shall be submitted to a general meeting of the Society for final ratification."

This resolution was seconded by Captain W. J. LIBERTY, who said that the Society could congratulate itself on the progress made, and on being put to the meeting it was declared carried unanimously.

The PRESIDENT, in winding up the meeting, moved a vote of thanks to Mr. J. S. Dow, Capt. W. J. Liberty, Mr. Justus Eck and Mr. C. W. Sully, who had aided him on the committee engaged in drafting the Articles and By-laws. The ease with which the meeting had been able to deal with them was a tribute to the labours of these gentlemen, and especially of the Hon. Secretary.

This vote of thanks having been carried with acclamation, Mr. C. W. SULLY proposed a vote of thanks to the President. What had been done was largely due to Mr. Paterson's efforts. Captain W. J. LIBERTY briefly seconded this resolution, which was likewise carried with acclamation, and the meeting then terminated.

Articles and By-laws of The Illuminating Engineering Society

(In what follows we give the final version of these Articles and By-laws submitted at the Special General Meeting of the Society on July 9th; the various amendments approved at this meeting being now incorporated therein.)

ARTICLES OF ASSOCIATION

1. The name of this Association shall be "The Illuminating Engineering Society."

2. The registered office of the Society will be situated in England.

3. The objects and purposes for which the Illuminating Engineering Society (hereinafter called "the Society") is hereby constituted are to promote the general advancement of illuminating engineering and the utilization of natural and artificial light and the dissemination of knowledge relating thereto, and for that purpose:—

(*a*) to hold meetings of the Society for reading and discussing communications bearing on illuminating engineering and the utilization of natural and artificial light, or upon subjects relating thereto;

(*b*) to hold or promote congresses on illumination, exhibitions of lamps, lighting appliances, instruments or other devices connected with illumination, or other applications;

(*c*) to print, publish, sell, lend or distribute the proceedings or reports of the Society or any papers, communications, works or treatises on illumination and its applications or subjects connected therewith, in the English or any foreign tongue, or any abstracts thereof, or extracts therefrom;

(*d*) to make grants of money, books, apparatus or otherwise for the purpose of promoting the advancement of knowledge of illumination, or invention and research therein, or in its applications, or in subjects connected therewith.

In pursuance of these objects the Society shall have power to invite the co-operation of kindred scientific and technical bodies, by inviting the presence in an advisory capacity of representatives of such bodies on committees or on the Council or by other methods calculated to promote the objects which the Society has in view.

4. The income and property of the Society, whencesoever derived, shall be applied solely towards the promotion of the objects of the Society as set forth in these Articles.

The Society shall not carry on any trade or business or engage in any transactions with a view to the pecuniary gain or profit of the members thereof. No member shall have any personal claim on any property of the Society and no part of the income or property of the Society shall be paid or transferred directly or indirectly by way of dividend or bonus or otherwise howsoever by way of profit to the members of the Society. Provided that nothing herein shall prevent the payment in good faith of reasonable and proper remuneration to any officer or servant of the Society, or to any member of the Society in return for services

actually rendered to the Society, nor prevent the payment of interest at a rate not exceeding 1 per cent. above bank rate per annum on any money lent, or reasonable and proper rent for premises demised or lent by any member of the Society, nor the gratuitous distribution among or sale at a discount to members of the Society who subscribe to its funds of any books or publications of the Society relating to all or any of its objects.

5. There shall be a Council of the Society consisting of such number of members, with such qualifications, and to be elected or constituted as such members of Council in such manner and to hold office for such period, and on such terms as to re-election and otherwise, as the By-laws of the Society shall direct.

6. The Society shall have such officers, with such functions, tenure and terms of office as the By-laws of the Society may prescribe, and such other officers and servants as the Council of the Society may from time to time appoint.

7. The government and control of the Society and its affairs shall be vested in the Council subject to the provisions of these Articles and to the By-laws of the Society. The business of the Council shall be conducted in such manner as the Council may from time to time prescribe.

8. Unless and until the By-laws of the Society shall otherwise provide there shall be six classes of membership of the Society, termed respectively Corporate Members, Sustaining Members, Honorary Members, Associate Members, Country Members and Corresponding Members. The members of the existing Society known as the Illuminating Enginering Society, who by virtue of these Articles become members of the Society, shall be deemed to have entered the Society as members of the same class as that to which they belonged in the said existing Society.

9. The qualifications, method and terms of admission, privileges and obligations, including liability to expulsion or suspension of members of each of the said six classes respectively, shall be such as the By-laws for the time being of the Society shall direct.

10. The Council shall have power to decide conclusively respecting each person proposed for or seeking admission to any class of membership of the Society whether he has or has not fulfilled such conditions as are applicable to his case.

11. The meetings of the Society shall be such as may from time to time be prescribed by the By-laws of the Society, and the rights of the several classes of members of the Society of attending and voting at the said meetings shall be such and subject to such restrictions as may be so prescribed.

12. The members or the majority of members voting at any duly convened Special General Meeting, with respect to which notice has been given of the matter to be taken into consideration thereat, shall have power from time to time to make such By-laws of the Society as to them seem requisite and convenient for the regulation, government and advantage of the Society, its members and property, and for the furtherance of the objects and purposes of the Society, and from time to time to revoke, alter or amend any By-law or By-laws theretofore made so that the same be not repugnant to these Articles or to the Laws and Statutes of this our Realm.

13. Pending the making and approval of the By-laws to be made under these Articles the existing Constitution and By-laws of the said Illuminating Engineering Society shall have effect.

14. The property and moneys of the said Illuminating Engineering Society shall be formally transferred to the Society or such person or persons on its behalf as the By-laws may prescribe.

15. The liability of the members is limited.

16. Every member of the Society undertakes to contribute to the assets of the Society in the event of the same being wound up during the time that he is a member, or within one year afterwards, for payment of the debts and liabilities of the Society, if any, contracted before the time at which he ceases to be a member, and of the costs, charges and expenses of winding up same, and for the adjustment of the rights of the contributories among themselves, such amount as may be required, not exceeding £1.

17. If upon the winding up or dissolution of the Society there remains, after the satisfaction of all its debts and liabilities, any property whatsoever, the same shall not be paid to or distributed among the members of the Society, but shall be given or transferred to some other association or associations having objects similar to the objects of the Society, and which shall prohibit the distribution of its or their income and property amongst its or their members to an extent at least as great as is imposed on the Society, such association or associations to be determined by the members of the Society at or before the time of dissolution, or, in default thereof, by such judge of the High Court of Justice as may have or acquire jurisdiction in the matter, and if and so far as effect cannot be given to the aforesaid provision, then to some charitable object.

18. True accounts shall be kept of the sums of money received and expended by the Society and the matters in respect of which such receipts and expenditure take place, and of the property, credits and liabilities of the Society. Once at least in each year the accounts shall be examined and the correctness of the statement and balance sheet ascertained by one or more properly qualified auditor or auditors.

BY-LAWS

DEFINITIONS AND SPECIAL PROVISIONS.

1. In these By-laws, except where the context forbids, words importing males are intended to include females and words implying the singular number are intended to include the plural number, and vice versa.

" The Society " means the Illuminating Engineering Society incorporated on

" The predecessors of the Society " means the Illuminating Engineering Society as existing prior to incorporation on

" Abroad " means outside Great Britain, the Irish Free State, the Isle of Man and the Channel Islands.

2. For the purposes of By-laws 31–33 any period of service as President, Vice-President or Ordinary Member of Council of the predecessors of the Society shall be deemed to be service in a similar capacity with the Society.

3. The nomination and election of Officers and Members of Council in the year shall be in accordance with the Constitution and By-laws of the predecessors of the Society in force on the 1st day of March.

MEMBERSHIP.

4. The Membership of the Society shall include Corporate Members, Sustaining Members, Honorary Members, Associate Members, Country Members, and Corresponding Members.

5. A Corporate Member may be anyone interested in the objects of the Society, but at the date of election shall not be less than 21 years of age.

6. An Associate Member may be anyone who

(*a*) is over the age of 16 years, but under the age of 21 years, and who is or has been pursuing a course of appropriate technical instruction at a recognized Institution.

(*b*) is over the age of 21 years and, whilst not technically connected with the lighting industry, sympathizes with the aims and objects of the Society.

Associate Members in class (*a*) shall automatically become Corporate Members of the Society on attaining the age of 21 years, and this alteration shall be announced at the next general meeting following their coming of age.

7. A Country Member may be anyone who is resident abroad or who resides not less than 50 miles from London. Persons so residing shall have the option of joining either as Corporate Members or under the conditions applying to Associate Members and in the latter case shall be designated " Country Members."

8. Sustaining Members may be societies, associations or firms who show their interest in the work of the Society by paying an annual subscription to its funds and have the privilege of nominating one representative who shall have the full privileges of corporate membership of the Society.

9. Honorary Members may be chosen from among those who are of acknowledged eminence in some branch of science related to illuminating engineering, or who, by reason of position, eminence or experience, have or may be enabled to render assistance in promoting the objects of the Society.

10. Corresponding Members are persons resident abroad who are not required to pay any subscription, but who receive the journal and in return assist the Society by sending contributions to discussions or by furnishing information on subjects on which they have special knowledge.

11. Associate Members, Country Members and Corresponding Members shall be entitled to all the privileges of membership except the right to vote and hold office therein.

12. The rights and privileges of any member of any class shall be personal to himself, and shall not be transferable or transmissible by his own act or by operation of law. No member shall, by reason of being a member of the Society, be entitled to any rights or privileges other than those which, by these By-laws, attach to the specific class of members of the Society to which he belongs.

13. Members may be of any nationality.

Admission of Members.

14. An application for admission to the Society shall be made in a form prescribed by the Council, and shall refer to at least two members of the Society; or if an applicant should not be personally known to two members, references may be accepted to members of professional societies of good standing, or to other persons whose good standing may be readily verified by the Council. If, in the opinion of the Council, further support for a member's candidature be considered necessary, the recommendations of four existing members shall be deemed sufficient; but the final consideration of a nomination for membership rests with the Council.

15. Candidates for admission as members must present a suitable form of application signed by two or more nominators, as directed above, as follows :—

> "We hereby recommend [here state name in full, date and place of birth, rank, profession or business, usual place of residence, and qualifications for membership of the candidate] as a fit and proper person to become a [here class of membership shall be stated] of the Illuminating Engineering Society [here must follow the names of two or more nominators, one of whom must have personal knowledge of the candidate]."

Applications will be considered at the next Council Meeting after they have been received. The names of those whose nominations have been accepted by Council will then be read out at the next meeting of the Society, and in the event of any objection being raised a ballot shall take place at the following meeting. A majority of three-quarters of those present shall entitle a candidate to election.

16. No person shall be entitled to any of the privileges of Membership until the annual subscription, or such other sum as is specified elsewhere as a composition in lieu of annual annual subscriptions, shall have been paid, and until the member shall have signed the following form :—

> "I, the undersigned, desire to become a Member of the Illuminating Engineering Society, and hereby promise that, if elected, I will submit and conform in all respects to, and be governed by, the terms and provisions of the Constitution and the By-laws made in pursuance thereof; provided that whenever I shall signify in writing to the Hon. Secretary that I am desirous of ceasing to be a member thereof, I shall be free from this obligation after payment of any annual subscription or arrears which may be due from me at that period."

17. A member may resign from the Society by a written communication to the Hon. Secretary at the offices of the Society, which resignation shall be accepted by the Council if the member's subscription has been duly paid.

18. Honorary Members shall be nominated by the Council or proposed in writing by at least fifteen members, the election in either case resting with the Council. Corresponding Members shall be elected by the Council. The names of Honorary Members or Corresponding Members elected by the Council shall be announced at the next General Meeting of the Society. Not more than one Honorary Member shall be elected in any one year and the number of Honorary Members shall not at any time exceed a total of six.

Diplomas.

19. Subject to such regulations and on payment of such fees as the Council may from time to time prescribe the Council may issue to any member of any class a certificate showing the class to which he belongs. Every such certificate shall remain the property of and shall on demand be returned to the Society.

Expulsion of Members.

20. In case any member shall (a) become bankrupt or lunatic or (b) shall be convicted of felony or any other criminal offence, the Council may decide that his name shall be removed from the Register of the Society and shall communicate such decision to such member.

21. Upon the receipt of a written request of not less than ten members that, for cause definitely stated in detail, a member of the Society should be expelled, the Council shall consider the matter, and, if there appears to be sufficient cause, shall advise the member concerned of the charges against him. The member may then present a written defence and appear in person before a meeting of the Council, who, within two months shall finally consider the case, and if the defence be deemed not satisfactory, the accused member shall be requested to resign and, in the event of his refusing to do so, shall be expelled upon a two-thirds vote of the total membership of the Council.

Subscriptions.

22. The annual subscription to the Illuminating Engineering Society shall be Two Guineas for Corporate Members, One Guinea for Associate Members and Country Members and not less than Five Guineas for Sustaining Members, which shall include one subscription to the official organ of the Society. Subscriptions shall become due on the 1st of January in each year.

23. Members of any class elected before the first day in July in any year shall pay the annual subscription for that calendar year, and those elected on or after the first day of July in any year shall for that calendar year pay half such annual subscription.

24. Honorary and Corresponding Members shall be exempt from all subscriptions.

25. Any member (other than a Sustaining Member) may commute or compound for all future payments and become a member for life, by payment of a sum not less than 15 guineas.

26. Any member of any class who has compounded by payment to the predecessors of the Society shall have the same rights and privileges as if he had compounded by payment to the Society.

27. If the annual subscription of any member residing in the United Kingdom shall be in arrear for three months, the Hon. Secretary shall give notice thereof to the member; and if the said subscription shall continue in arrear at the expiration of six months after such notice, the Council, having through the Hon. Secretary given the defaulting member a further three months' notice of their intention, shall have power to strike the name of such member off the register, and he shall thereupon cease to be a member of the Society, and shall cease to receive the official organ but shall remain liable for any arrears of subscription which shall be due at the date of cessation of membership.

28. A member whose name has been removed from the list of membership may be reinstated by the Council and retain his original date of election upon payment of all outstanding arrears of subscription, being then entitled to a complete file of the official journal of the Society which he would otherwise have received, if in stock.

29. The Council may in any special case, where in their opinion it is desirable to do so, reduce or remit the annual subscription, or the arrears of annual subscription, of any member of any class.

Officers.

30. There shall be a President, three Vice-Presidents, an Honorary Secretary and an Honorary Treasurer of the Society.

Constitution and Election of the Council.

31. The Council shall consist of :—

The President,
The Past Presidents,
The Three Vice-Presidents,
The Honorary Treasurer,
The Honorary Secretary,
The Ordinary Members of Council, who shall not exceed 24 in number,
The Chairman of each Local Centre, if any,

whose offices shall be honorary and without remuneration.

Any case of doubt or difficulty as to eligibility for or retirement from office shall be decided by the Council.

The President.

Except in special circumstances, the President shall be chosen from those who are or have been Vice-Presidents. He shall retire each year at the opening meeting of the Session, and shall not be eligible for re-election until at least one year after the termination of his period of office, which shall be for one year only.

The Vice-Presidents.

The Vice-Presidents shall be members of the Society. The period of office of a Vice-President may be for three years, and no person shall hold that office for more than three years in succession.

The Honorary Treasurer shall be chosen from those who are or have been members of Council. He shall retire each year at the Council Meeting preceding the opening meeting of the Session, and shall be eligible for re-election, but no person shall hold the office of Honorary Treasurer for more than three years in succession.

The Honorary Secretary shall be chosen from those who are or have been members of the Council. He shall retire each year at the Council Meeting preceding the opening meeting of the Session, but shall be eligible for re-election.

Ordinary Members of Council.

Ordinary Members of Council shall be Corporate Members of the Society and shall number not more than 24, selected with a view to securing so far as possible appropriate representation to the different groups interested in illuminating engineering. Not less than one-third of this number shall retire annually. The Ordinary Members retiring each year shall be those whose elections bear the earliest dates. The period of office of an Ordinary Member of Council may be

three years, and no person shall hold that office for more than three years in succession; and no person who has previously held office as an Ordinary Member of the Council for a period of three years in succession, or as Vice-President, or Honorary Treasurer, shall hold office as an Ordinary Member of Council unless at least one year shall have elapsed since the expiry of such period of three years or since he last held the office of Vice-President or Hon. Treasurer respectively.

Advisory Members of Council.

The Council shall have power to invite kindred societies and associations to nominate a representative to attend in an advisory capacity meetings of the Council. Such representatives of kindred societies and associations shall be designated Advisory Members of Council and shall not be entitled to vote on matters other than those for the consideration of which they have been invited.

NOMINATIONS FOR ELECTION TO THE COUNCIL.

32. Not later than March 15th in each year the Council shall send to each member of the Society entitled to vote a list of the existing Officers and Council, of vacancies occurring, and of duly qualified persons whom they nominate for the vacancies about to occur in the offices of President, Vice-Presidents, Honorary Treasurer, Honorary Secretary and Ordinary Members of the Council.

The list of persons nominated by the Council for the vacancies in the office of Ordinary Members of Council shall contain the names of at least three persons who have not previously served on the Council in any capacity.

After the issue of the Council's list, and not later than the 15th day of April next following, any ten members (but not more than ten) may nominate any other duly qualified person to fill any such vacancy by delivering such nominations in writing to the Honorary Secretary, together with the written consent of such person to accept office if elected, but each such nominator shall be debarred from nominating any other person for the same election.

In the event of an election being necessary, a postal ballot shall be conducted, and the Council shall appoint two scrutineers, who, at the meeting of the Council prior to the Annual General Meeting, shall examine and report upon the result of the ballot. The candidates receiving the majority of votes will be duly elected, and the result of the election announced at the Annual General Meeting.

OFFICIAL VACANCIES.

33. Vacancies in the offices of President, Vice-Presidents, Honorary Treasurer, Honorary Secretary, and Ordinary Members of the Council, other than those arising under the By-law 31, may be filled by the Council, and the name of each person selected shall be announced at the next Ordinary Meeting of the Society, but the person so chosen shall retain his office only so long as the vacating Member of Council would in the ordinary course have retained office, and any period of office so served shall not be taken into account in computing the period of office under the provisions of By-laws.

The office of a Member of the Council shall *ipso facto* be vacated (*a*) if by notice in writing to the Society he resigns his office, or (*b*) if he ceases to be a member of the Society, or (*c*) if he becomes bankrupt or lunatic.

PROCEEDINGS, POWERS AND DUTIES OF THE COUNCIL.

34. The Council shall direct and manage the property and affairs of the Society in accordance with the Articles and By-laws of the Society, and may exercise all such powers of the Society as may be exercised by the Society, and which are not required hereby or by the Articles to be exercised by the Society in General Meeting.

35. The Council shall meet as often as the business of the Society may require and in any case not less frequently than every two months during the Session, and at every meeting of the Council five shall constitute a quorum. The President or any two Vice-Presidents or any three members of the Council may, and the Hon. Secretary shall, on the request of such officer or officers or members, convene a meeting of the Council.

36. At any meeting of the Council each member of Council present shall, save as hereinafter mentioned, have one vote, and the Chairman shall have a casting vote. Any two members present are entitled to demand that the voting shall be by ballot, and in any ballot so demanded the three Past Presidents present who have just held the office of president and any other Past President who is at the time serving on any committee of the Council shall be the only Past presidents competent to vote.

37. The Council may appoint committees chosen from their own body and committees for special purposes consisting of members of Council and Corporate Members, or Associate Members and others, with such powers as the Council may prescribe. The President, Hon. Treasurer, and Hon. Secretary shall be ex-officio members of all committees.

38. The Council shall cause to be kept proper and sufficient accounts of the capital, funds, receipts, and expenditure of the Society, so that the true financial state and condition of the Society may be at all times exhibited by such accounts.

39. The financial year of the Society shall end on the 31st day of December in each year and the accounts of the Society shall be made up each year to that date, and, after having been approved by the Council and examined and found correct by an Auditor or Auditors, shall be laid before the Annual General Meeting next following.

40. The appointment, powers, and duties of the Auditor or Auditors shall be regulated as nearly as may be and with the necessary modifications in accordance with the provisions of Sections 112 and 113 of the Companies (Consolidation) Act, 1908, or with any statutory modification thereof for the time being in force, as if the Society were a company registered under the Act.

41. The Council may, on the recommendation of the Hon. Secretary, appoint a paid Secretary, who shall be under the direction of the Hon. Secretary and aid him in all matters and shall pay to the Secretary and to the clerks and servants of the Society such salaries, wages or remuneration as the Council shall from time to time think proper, and the Council shall make such provision for and grant such pensions to the Secretary, clerks and servants after their retirement from the service of the Society as the Council think proper.

THE HONORARY SECRETARY.

42. The Hon. Secretary shall be the executive officer of the Society, under the direction of the Council. He shall prepare the business for the Council and record the proceedings thereof. He shall collect all moneys due to the Society, and deposit the same subject to the order of the Treasurer. He shall personally certify the accuracy of bills or vouchers upon which money is to be paid, and shall draw and countersign all cheques, which shall be signed by the Treasurer. He shall have charge of the books and accounts of the Society, and shall furnish monthly to the Council a statement of receipts and expenditures and monthly balances. He shall prepare annually a report for the Council and from time to time shall furnish such statements as may be required. He shall conduct the correspondence of the Society, and keep full records of its proceedings. In fulfilling all such duties the Hon. Secretary shall receive the assistance of a paid Secretary and other clerks or servants of the Society, if and when appointed by the Council.

43. The Council may, upon the receipt of a request to that effect from any society with objects kindred to those of the Society, arrange for the union, alliance, or incorporation of such society with the Society; and they may also, if they think fit, remit or reduce the entrance fees of the members of such society at the time of union, alliance, or incorporation; provided that no such union, alliance, or incorporation shall be effective unless it is sanctioned by a Special General Meeting of Corporate Members and Sustaining Members.

OFFICIAL JOURNAL OF THE SOCIETY.

44. *The Illuminating Engineer,* published by the Illuminating Engineering Publishing Co., Ltd., in London, shall be the official journal of the Society, and proceedings and announcements of the Society, etc., shall be published therein, subject to an Agreement which shall be entered into between the Council of the Society and The Illuminating Engineering Publishing Co., Ltd., and until such an Agreement be entered into the existing arrangement approved by the Council of the predecessors of the Illuminating Engineering Society shall remain in force.

PUBLICATIONS.

45. Papers read or lectures delivered before the Society shall not be published in full elsewhere than in the official organ of the Society without permission of the Council. Abstracts of lectures, papers, and other contributions may only be published after the actual date of reading or delivery.

COPYRIGHT.

46. Every paper presented to the Society, and accepted for reading or for publication in full or in abstract, and every paper read before the Society or a local centre, and the copyright thereof, shall be the property of the Society. The Council, in such cases as they may think fit, shall have power to release or surrender the rights of the Society in respect of any such paper or the copyright thereof. The right of publishing all such papers and the reports of the proceedings and discussions at meetings of the Society and of the local centres shall be reserved to the Council, who may, as they think fit, give their consent to publication in approved cases.

SESSIONS AND MEETINGS.

47. The Session of the Society shall begin on or about the 1st of November in each year and terminate on or about the first day of June in the following year. Meetings of the Society shall be held at such places and at such times as the Council may appoint.

48. The meetings of the Society shall be as follows :—

(*a*) Ordinary General Meetings for the reading of and discussion of papers on illuminating engineering or allied subjects, and for lectures and discussions on those subjects.

(*b*) The Annual General Meeting.

(*c*) Special General Meetings.

Corporate Members and Honorary Members shall alone be competent to vote at the Annual General Meeting or Special General Meetings and subject to By-law 27 each person voting shall have only one vote.

49. In addition to the Ordinary General Meetings specified in By-law 48 the Council may at their discretion arrange for other meetings to be held for the dissemination of knowledge of illuminating engineering and allied subjects and the discus-

sion of papers thereon; and the Council shall determine the conditions of admission to such meetings and the manner in which they shall be conducted.

50. The Ordinary General Meetings of the Society shall be conducted as prescribed by the Council from time to time.

51. Every member of any class shall have the privilege of introducing visitors at each Ordinary General Meeting of the Society, by writing his name in a book provided for that purpose, or supplying him with an admission ticket to be obtained from the Secretary.

52. No question shall be discussed, or motion be made, at an Ordinary General Meeting relating to the direction and management of the Society.

53. The Annual General Meeting shall be held in the months of May or June. The business of the Annual General Meeting shall be to receive and consider the Report of the Council and the accounts of the Society for the past year; to elect Auditors; and (with the approval of the Council) to transact any other business of which notice in writing shall have been given to the Secretary at least one month before such meeting.

54. A Special General Meeting may be called at any time by the Council for any specific purpose relating to the direction and management of the affairs of the Society, and the Council shall at all times call such a meeting on a requisition, in writing, of ten Corporate Members, specifying the general nature of the business to be transacted.

Alterations in By-laws.

55. Notice of any alteration in the By-laws must be given to the Hon. Secretary in writing, and must be signed by not less than ten Corporate Members. The Council shall consider such proposals and shall appoint a Special General Meeting for the discussion thereof, of which at least fourteen days' notice shall be given, and at which a vote may be taken in the manner prescribed in By-laws 57-59. Alternatively the Council may, at their discretion, arrange for a letter-ballot to be conducted in the manner prescribed in By-law 32. An affirmative vote of two-thirds of the entire vote cast by qualified members of the Society shall then be necessary to secure the adoption of an amendment. An amendment shall take effect twenty days after its adoption.

56. If no quorum be present at a meeting called to consider an alteration in the By-laws of the Society, the Council shall proceed to call a second meeting not later than two months after the first before a decision in the matter can be taken.

Proceedings at Meetings.

57. Votes may be given at any Annual or Special General Meeting either personally or by proxy. On a show of hands every member of any class present in person and entitled to vote at such meetings shall have one vote. In case of a poll every member of any class present in person or by proxy and entitled to vote at such meeting shall have one vote.

58. No persons shall be appointed a proxy to vote at any meeting who is not entitled in his own right to vote at such meeting.

59. The instrument appointing a proxy shall be in writing under the hand of the Appointer or his Attorney, and shall as nearly as circumstances will admit be in the form or to the effect following:—

The Illuminating Engineering Society.

I of
being (a Corporate Member) of the above Society hereby appoint
of or
failing him of
as my proxy at the (Annual General Meeting or Special General Meeting as the case may be) of the Society to be held on the day of 19 and at any poll held in connection therewith.

As witness my hand (this) day of 19

Signature.....

Class of Membership in I.E.S.....

60. The instrument appointing a proxy and the power of attorney (if any) under which it is signed shall be deposited at the office of the Society not less than one week before the time for holding the meeting at which the person named in the proxy proposes to vote but no instrument appointing a proxy shall be valid after the expiration of six calendar months from its date except on a poll demanded at a meeting in cases where the meeting was originally held within six calendar months of such date.

61. A vote given in accordance with the terms of an instrument appointing a proxy shall be valid notwithstanding the previous death of the principal or revocation of the proxy unless previous intimation in writing of the death or revocation shall have been received at the office of the Society.

62. In the case of an equality of votes the Chairman of the meeting shall both on a show of hands and at a poll have a casting vote in addition to his personal vote.

63. The quorum at any Annual or Special General Meeting shall be twelve of those persons entitled to be present and vote thereat and no business shall be transacted at any such meeting unless the quorum be present at the commencement of the business. If a quorum be not present within a quarter of an hour from the time appointed for holding the meeting the meeting shall be dissolved.

64. Fourteen days' notice at the least shall be given of all Annual and Special General Meetings. The notice shall specify the general nature of the business to be transacted, and no other business shall be transacted at these meetings except such business (if any) at an Annual General Meeting of which notice shall have been given as provided in By-law 54.

The accidental omission to give notice of a meeting to any member of any class shall not invalidate the meeting.

65. The President shall preside at all meetings of the Council and Ordinary, Annual and Special General Meetings of the Society at which he is present; in the absence of the President, one of the Vice-Presidents, or, if none be present, a member of Council appointed by the meeting shall preside.

Local Centres.

66. The Council may, at their discretion, upon receipt of a request to that effect from a sufficient number of members resident in any district, create a local centre of the Society in such district for the holding of regular meetings, for the reading of papers and for discussions on illuminating engineering, and the Council shall have power to dissolve such local centre at any time after it has been formed.

67. Each local centre shall be constituted, and its affairs shall be carried on, in accordance with rules and regulations to be laid down from time to time by the Council, and it shall elect annually for its Chairman a Corporate Member of the Society. Members residing within 50 miles of a local centre which they desire to join shall do so as Corporate Members, but Country Members who reside more than 50 miles from London and also more than 50 miles from any local centre shall have the option of continuing in this class of membership and of attending meetings at either place.

Investments.

68. All the moneys of the Society not required to meet the current expenditure of the Society shall be invested in any of the Public Funds or Government Securities, or with the Commissioners for the Reduction of the National Debt, or in Debentures, or Debenture Stock or Preference Shares or Stock of any British Railway Company paying a dividend on its Ordinary Share Capital, or in the Stocks, Shares or Debentures of any East Indian or Colonial Railway or other Company receiving or entitled to a percentage or fixed Annual Dividend from the Indian or Colonial Governments, or in the public Stocks or Funds of any Colony or Dependency of the United Kingdom, or on Security of Rates of any Municipal Corporation, or upon Real Securities, or in the purchase of Freehold or Leasehold Hereditaments or Ground Rents in England, or in any mode in which Trustees are or shall be by law, in absence of special direction, authorized to invest moneys under their control.

Indemnity.

69. Each member of the Council shall be accountable in respect of his own acts only, and shall not be accountable for any acts done or authorized to which he shall not have expressly assented. And no member of the Council shall incur any personal liability in respect of any loss or damage incurred through any act, matter, or thing done, authorized or suffered by him, being done in good faith for the benefit of the Society, although in excess of his legal power.

70. The members of the Council and the Honorary Secretary shall be indemnified out of the funds and property of the Society from and against all costs, charges, damages, and expenses whatsoever which they or any of them shall sustain by reason of their respectively accepting office or acting in execution of the duties or powers imposed upon or given to them by the Charter or the By-laws of the Society.

Common Seal.

71. The Council shall provide a Common Seal of the Society and make rules for the safe custody and the use thereof, and it shall never be used except by the authority of the Council previously given, and in the presence of two members of the Council at the least, who shall sign every instrument to which the seal is affixed, and every such instrument shall be countersigned by the Honorary Secretary, or some other person appointed by the Council.

Notices.

72. Any notice may be served or any communication may be sent by the Council or by the Honorary Secretary of the Society upon or to any member of any class, either personally or by sending it prepaid through the post addressed to such person at his address as registered in the books of the Society.

73. Any notice of communication, if served or sent by post, shall be deemed to have been served or delivered on the day following that on which the same is posted; and in proving such service or sending it shall be sufficient to prove that the notice or communication was properly addressed and posted.

74. No member of any class, whose registered address is abroad, shall be entitled to any notice; and all proceedings may be had and taken without notice to such person in the same manner as if he had had due notice.

Glare and Visibility in Artificially Lighted Streets

An Experimental Investigation carried out at Sheffield in July, 1928

By W. S. Stiles, B.Sc. (The National Physical Laboratory)

The tests described were carried out in Sheffield in July, 1928, on a number of street lighting-installations specially erected for the Conference of the Association of Public Lighting Engineers. Measurements of eye sensitivity (as measured by the least difference of brightness detectable) were made, using a special set of contrast discs. The eye sensitivity depends on the direction in which the observer looks, and varies with the number of lamps in the field of view, their candle-powers, mounting height and distance away. The most important direction of view in practice is that for an observer in the middle of the roadway with his gaze directed horizontally along the length of the street. The eye sensitivity measurements were made for this direction of view, and the results obtained correlated well with those computed using formulæ established by laboratory investigations.

Methods of appraisal depending on personal opinion were also employed. The following general results were obtained:—

(i) The observer chooses, as the position of maximum glare in the span, a position where the depression of eye sensitivity due to the first lamp (as computed from the laboratory formula) is a maximum.

(ii) The observer's estimates of the intensity of glare correlate with the depression of eye sensitivity due to the first lamp (rather than with the total depression of eye sensitivity due to all the lamps). The evidence as a whole suggests that in estimating glare the observer depends for his judgment on the general sensation of discomfort produced by the most glaring source in the field, but that the depression of eye sensitivity and the discomfort effect due to a given lamp rise and fall together.

(iii) For the ten installations tested, the estimated visibility and the estimated intensity of glare tend to increase together. The bearing on the B.E.S.A. Street Lighting Specification of the results obtained is discussed. In particular, the Glare Clause of the Specification is found to require revision.

Introduction.—At the Annual Meeting and Conference of the Association of Public Lighting Engineers, held in Sheffield in July, 1928, a number of street-lighting installations were on view specially erected by Mr. Colquhoun, Public Lighting Engineer to the City of Sheffield, to demonstrate the British Standard Specification for street lighting. It was considered by the Illumination Research Committee that the presence of a large number of lighting engineers in Sheffield and the availability of these special installations presented an excellent opportunity for carrying out comparative tests on different lighting systems. The choice and arrangement of such tests were placed in the hands of the National Physical Laboratory, and the present paper is an account of the investigation made.

The value of the tests, and particularly of the A tests, depended on having a considerable number of observers taking part, and the delegates to the Conference were successfully appealed to to act in this capacity. In addition, two assistants were required at each installation to conduct the tests. The assistants were members of the Laboratory Staff or gentlemen engaged in the research departments of various firms interested in street lighting.

TABLE I.

Installation No.	Illuminant	Description of fitting	Consumption	Arrangement of lamps	Appendix II B.E.S.A. Specification Fig.	Width of carriageway Ft.	Average distance between lamps Ft.	Average list'nce, test point to two nearest lamps Ft.	Height of light source Ft.	Spacing Height ratio	Horizontal Illumination Min. in ft. cdls.	Horizontal Illumination Max. in ft. cdls.	Ratio: Min. Max. Illum.	Class	Installation No.
21	Elec	Copper lantern; dome reflector	300 w.	Centre light'g	4	72	105	64	28	3·7	·100	0·5	1 : 5	E	21
29	„	"Housing" lantern enamel reflector	500 w.	Stagg'd	2	45	94	54	25	3·7	·160	2·1	1 : 13	E	29
30	„	Two-way band reflector	500 w.	„	2	39	112	60	25	4·4	·100	1·0	1 : 10	E	30
32	„	Dome mirror reflector fitted with diffusing screen	500 w.	„	2	37	120	64	25	4·8	·080	1·2	1 : 15	F	32
33	„	Dome mirror reflector only	500 w.	„	2	37	93	52	25	3·7	·100	1·2	1 : 12	E	33
36	„	Enamelled reflector with glare screen	500 w.	„	2	40	109	59	25	4·3	·140	2·5	1 : 18	E	36
37	„	Dome refractor	500 w.	„	2	40	117	63	25	4·6	·105	1·7	1 : 16	E	37
38	„	Refractor bowl, 2-way	300 w.	„	2	40	106	57	25	4·2	·225	0·45	1 : 2	D	38
42	„	Enamelled trough reflector	500 w.	„	2	33	121	63	22	5·5	·130	2·6	1 : 20	E	42
44	Gas	10-light medium mantles	25 c.f.	„	2	31	74	41	15	5·0	·250	3·0	1 : 12	D illn. E Mounting	44

Description of the Tests.—There are at the present time no well-established principles enabling the merits of lighting installation to be estimated, and recourse must be had to methods of appraisal which depend on personal opinion. The tests A described below were framed with the idea of collecting, for a series of different street-lighting installations, personal judgments of visibility and glare made under something like control conditions. The test B is an attempt to measure directly in actual installations the brightness difference threshold, i.e., the least difference of brightness perceptible, for an observer standing at a specially chosen point and looking in a selected direction. The magnitude of the threshold is undoubtedly a factor in determining the visibility in the street, and much of the published work on street lighting, including the Glare Appendix of the British Engineering Standards Association Specification, depends on a consideration of the value of the threshold under different conditions.

It was impracticable, with the limited time available at the Conference,* to make tests on all the 49 installations exhibited and ten were chosen for the purpose. Of the installations selected, seven fell into Class E of the B.E.S.A. Specification, two into Class D and one into Class F. It was considered likely that more useful information could be obtained by confining the investigation to two or three adjacent classes of the Specification than by attempting to cover the whole range of classes. The details of the ten "test installations" are given in Table I. They have been drawn from the Presidential Address to the Association of Mr. Colquhoun.

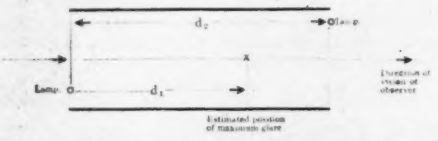
* There was only one evening suitable, that of Tuesday, July 10th.

Notes for the Guidance of Observers.

TEST A. The general visibility is to be assessed in an arbitrary scale ranging from 0 to 5, the higher the number the greater the visibility.

The degree of glare is to be assessed in an arbitrary scale ranging from 0 to 5, the higher the number the greater the glare.

The distances d_1 and d_2 are to be ascertained by pacing. The accompanying sketch indicates the measurements required:



TEST B. A series of ten discs will be displayed in turn, on the special stand. Each disc will be exposed for 30 seconds and the number of the disc will be called out by the assistant. If the observer is able to discern the contrast spot on the disc, he should note down the position in the appropriate place on the card, as N, SW, E. etc. If the observer cannot detect the contrast spot a cross (X) should be entered on the card. It is particularly requested that observers make all their entries on the card independently of other observers and that discussion on the tests shall be postponed until the measurements are completed.

A specimen entry for the imaginary installation No. 0 is shown on the results table.

The National Physical Laboratory.

TEDDINGTON.

Tests of street lighting installations on view at the Annual Meeting and Conference of the Association of Public Lighting Engineers, in Sheffield. July, 1928.

RESULT CARD.

Observer's Name

N.B.—Kindly hand this card to the guide on the completion of the experiments.

FIG. 1.

The tests were carried out on the night of July 10–11. The weather was fine. A strong breeze was blowing and there had been rain during the day, which was not completely dried up. The observers were first taken round in motor coaches and viewed the complete series of 49 installations. They were then divided into groups of about four or five, each group being taken to one of the ten test installations. Each group carried out tests A and B and then passed on to the next installation, visiting in this way all the installations in turn.

At each installation, each observer was asked:

(1) To assess the general level of visibility in the installation, on an arbitrary scale ranging from 0 to 5, the higher the number the greater the visibility. No restriction was placed on observers as to what criterion of visibility they should employ.

(2) To determine the position on the middle line of the street at which glare was considered to be a maximum, the position to be defined by pacing out the distances d_1 and d_2 shown on the back of the result card (see Fig. 1 and below). In determining this position the observer was required to walk down the middle line of the street, with eyes looking straight to the front and at their own level.

(3) To assess at the estimated position of maximum glare the intensity of the glare, in an arbitrary scale ranging from 0 to 5, the higher the number the more intense the glare.

These constituted the A tests, for which about five minutes were allowed. The observer recorded his findings on a result card (Figs. 1 and 2), which he took with him from one installation to another until the end of the tests, when the cards were collected.

		Number of Installation under Test.											
		0	21	29	30	32	33A	33B	36	37	38	42	44
TEST A.	General Visibility 0 to 5	3	4	3	3	3	3	2	3	3	3	4	4
	Degree of Glare 0 to 5	1	3	3	3	3	1		3	4	4	4	3
	d_1 in paces	32	12	18	20	25	12	22	23	12	10	18	10
	d_2 in paces	57	37	34	41	40	28	8	35	34	36	33	41
TEST B.	Test Disc No. 1	N	SW	NE	W	NE	E	X	SW	SW	S	S	SE
	" " 2	SW	X	N	NW	N	NE	X	X	X	SE	NE	X
	" " 3	X	N	SE	E	NW	S	NW	NW	X	NW	NW	N
	" " 4	E	X	X	X	NW	NW	W	X	X	X	NE	X
	" " 5	X	S	E	NE	X	N	NE	SW	N	N	SE	W
	" " 6	X	X	X	X	X	NE	X	X	NE	NW	X	NW
	" " 7	NE	N	X	W	E	NW	S	NE	X	SW	S	X
	" " 8	S	X	N	NE	X	W	X	X	X	X	X	X
	" " 9	X	X	E	X	N	W	X	N	N	W	NW	SE
	" " 10	W	SW	X	E	X	X	X	NE	X	X	X	X

FIG. 2

For the B tests the observers were stationed at a previously selected observation position in the middle of the road. Eighty feet from this position, and again on the middle line of the road, a wooden stand was erected on which specially constructed contrast discs could be exposed to the observers' view. Photographs of one of the stands used are shown in Figs. 3 and 4, and a scale diagram of a typical disc with explanatory notes in Fig. 5. Ten contrast discs, with different reflection factor differences between test spot and background, were exposed in turn for a period of from 10 to 30 seconds each. As each disc was placed on the stand by the assistant, its number was called out and the observers then noted in their result cards the position of the test spot on the disc as N, SE, NE, W, etc. Where the contrast was insufficient for the observer to decide on the position of the test spot a cross had to be entered in the appropriate place on the card.

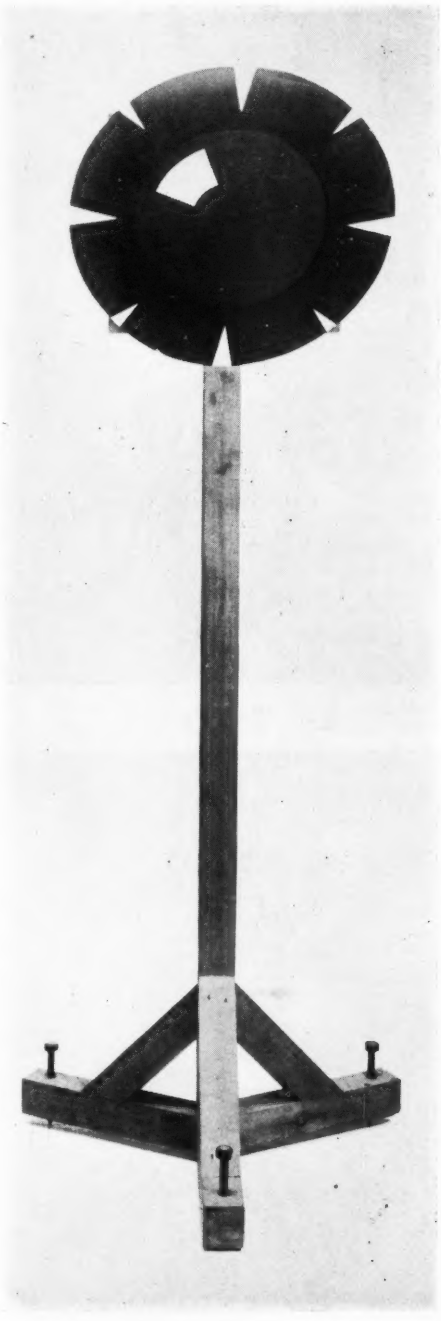


FIG. 3.

The tests were carried out, in all the installations except No. 44, in the span between the first pair of lamps belonging to the particular installation, the direction of vision of the observer being of course towards the remaining lamps of the installation. Installations 32 and 33 were contiguous and consisted each of only three lighting units, installation 42 comprised five and each of the remaining installations six or more lighting units.

Thirty-four observers participated in the observations. If each had visited all the ten test installations 340 sets of observations would have been obtained. Actually, 331 sets were recorded. In addition, the gentlemen who acted as assistants on the night of the main tests, carried out observations for Test B on the night of July 9–10. The results agreed well with those obtained subsequently in the main tests and are not discussed further in the present account.

Subsidiary Measurements, etc.—For the interpretation of the results of the B test, measurements of vertical illumination were made in the test span of each installation.*

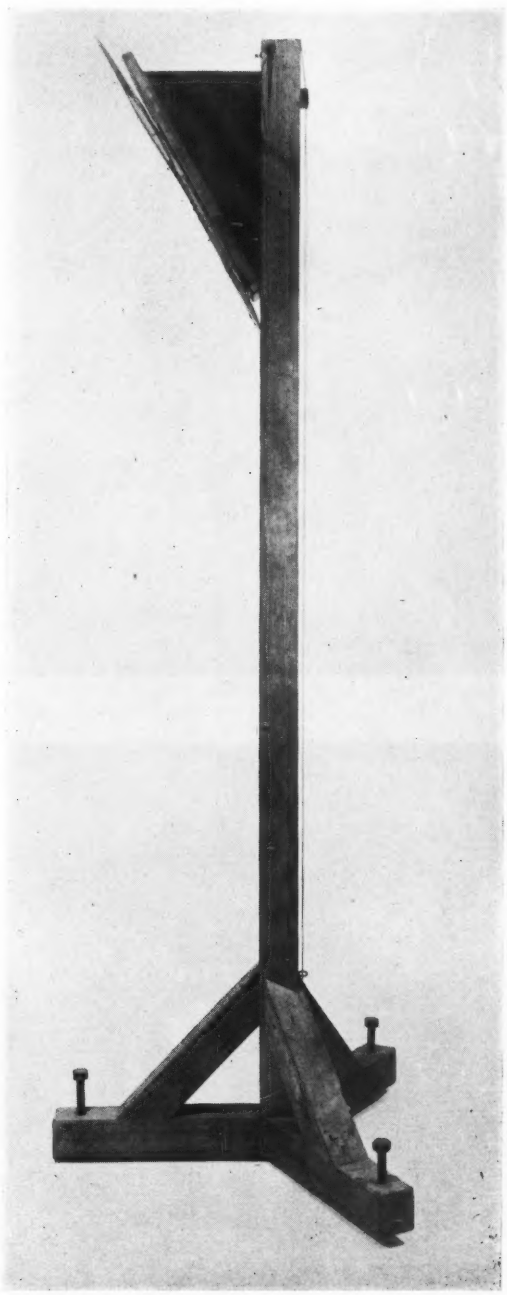


FIG. 4.

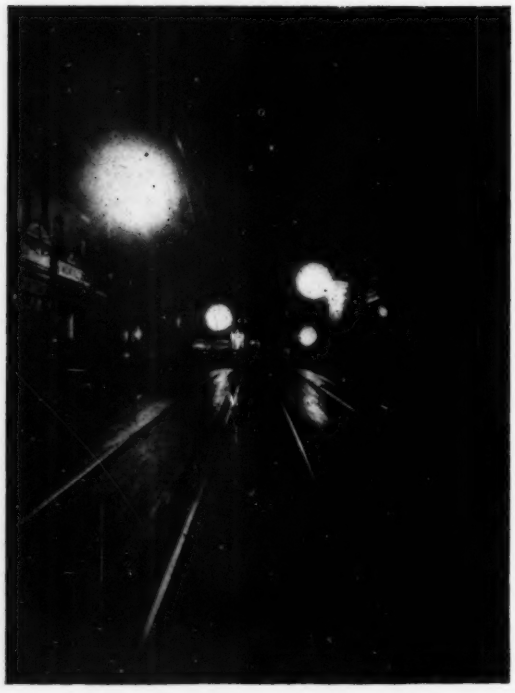
* Most of the measurements were made in the evenings immediately preceding the night of the tests. Those for Installations 38, 42 and 44 were made about a fortnight before the Conference. For these installations no change in the fittings, etc., was made between the illumination measurements and the tests.

A Macbeth illuminometer was used, with the test surface placed at different points on the middle line of the street, at a height of 5 feet from the ground with its normal parallel to the middle line. Two vertical illuminations were determined: (1) E the total vertical illumination due to all the lamps and to reflections from walls and road surface, (2) $E-E_1$ the total vertical illumination less the contribution E_1 of the nearest lamp. The results of the measurements are summarized in graphs, an example of which for installation 37 is shown in Fig. 6. The abscissa in these graphs is $y=\frac{x}{s}$ where s is the length of the test span and x is the distance measured along the middle line, from the observation point to the point marking that end of the test span which is in front of the illuminometer test surface. Thus the vertical illuminations measured are those incident on an observer's eyes as he walks along the test span from $y=1$ to $y=0$. For installations 38 and 42, only the measurements of E were completed, $E-E_1$ being determined, however, for certain special positions (including the Test B observation position).

It was further necessary, in computing the expected value of the brightness difference threshold, to know the number of light sources and their disposition in the visual field of an observer carrying out Test B. This was most conveniently accomplished by taking a photograph of each installation with the camera placed, at the observation position, at a height of 5 feet and pointing along the middle line of the road. Four of the photographs obtained in this way are reproduced in miniature in Fig. 7. In each photograph an assistant is seen standing at the place occupied by the disc stand in the tests. A small lamp

Installation No. 21.

Installation No. 29.



Installation No. 30.

Installation No. 32.

FIG. 7.

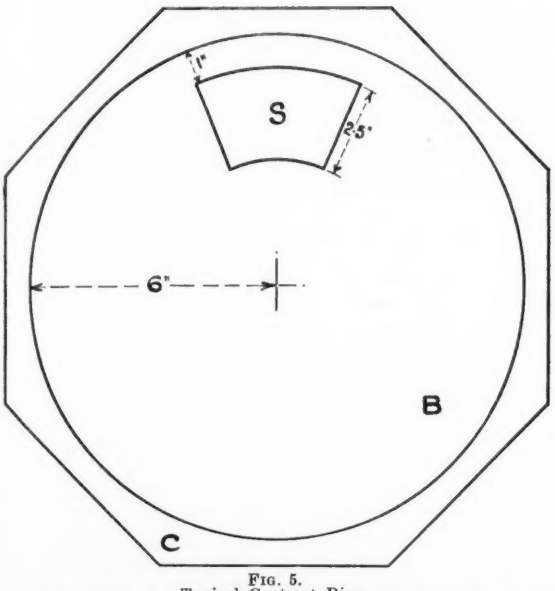


FIG. 5.
Typical Contrast Disc.
Gaslight S {Test spot of reflection factor between 4 and 20 per cent.
Paper B {Background of reflection factor approximately 4 per cent.
Cardboard C {Specially cut to drop into slots in stand with the test
Mount {spot in any one of eight possible positions.

mounted on a 5-foot rod held by the assistant indicates the position of the contrast disc centre. These photographs were taken several weeks after the Conference and when some of the special fittings had been replaced. The number of light sources and their arrangement in the field are, however, just the same as on the night of the tests.

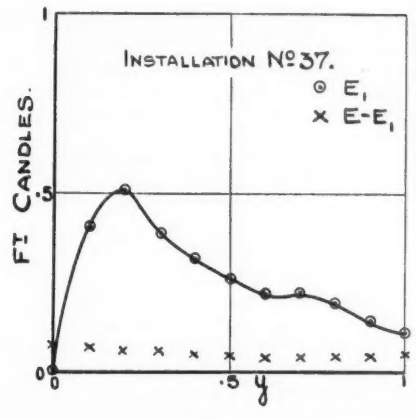


FIG. 6.

The illuminations E_D incident on the contrast discs when set up in position for Test B were measured on the night of the main tests and are recorded in column 3 of Table III.* They were necessary in order to convert the reflection factor differences of the discs into actual brightness differences.

(To be continued.)

The Actinity of Light Sources

By Dr. H. LUX

THE production of the Planck radiation equation and the investigation of the optical sensitivity curve have brought the endeavours made in illumination matters, at least in their theoretical aspect, to a more or less definite conclusion. The equation does not, however, take fully into consideration the actinity or photochemical power of the radiation. The difficulties encountered during research in this direction are very much greater than those met with in investigations of the effects of radiation on the eye, as with photochemical results there are an exceedingly great number of properties to be considered in the receiving media to which a precise definition of spectral sensitivity cannot be attached. It was formerly accepted as reasonable to assume that the short waves of the ultra-violet to the blue band of the spectrum produced the greatest effects, but now it is acknowledged that by sensitization of the receiving material the long waves of the visible spectrum, even including the infra-red ones, can be utilized in photochemical operations. The sensitization in such cases acts on the vibrations of the electrons as a tuned resonator, enabling them to originate chemical conditions or set them into action. The combinations found in nature or used in photochemical operations possess such different degrees of sensitization that the photochemical influence of light radiation on one receiving medium cannot be expected to produce similar results with another variety of recipient.

No standard receiving medium universally suitable for photochemically active radiation exists that responds in a similar way to that in which the average standard eye reacts to the excitation produced by visible rays. Although the illuminating power of the radiating body, especially if it is one that is radiating heat, emanating from either its temperature or temperature-colour, is accurately observable, this characteristic quality is entirely absent when its actinic value has to be taken into consideration.

In the endeavours hitherto made to confine investigations to a standard, receivers of radiations have not attained consistent results, as such receiving media can only be reproduced with the greatest difficulty.

Suppose, for instance, one decides to adopt a photographic coating as the receiver of radiation, then the actinity of the light source must be determined by the blackening that results.

The blackening "S" is a function of the actinic intensity i and the duration of the illumination t therefore

$$S = f(it^p)$$

In this well-known Schwarzschild equation the exponent p is also dependent on one of the variables of the photographic surface, namely, the wavelength λ the intensity i, while the duration of the illumination introduces still further complications, as if the illumination is intermittent the blackening effect is less than if there is continuous exposure to the radiations for the same total period.

The Schwarzschild function has been empirically stated by Kellner† as

$$S = me^{-g(it^p)^{-\frac{1}{2}}}$$

in which the exponent stated also in an empirical manner is

$$P\lambda = a\lambda + b\lambda e^{-c\lambda[\log(it)]^2}.$$

The values of m, g, a, b, c are constants dependent on the kind of plate chosen, while a, b, c are additionally affected by the wavelength.

No further discussion is required to show that practical actinometry, if based on the blackening formula, is far too complicated and cumbrous for ordinary purposes. Moreover, its adoption would not advance actinic measurement, as the determination of its values would hold good only for the actual plate used, and as identical replicas of this could not be produced with certainty the figures would therefore be valueless for any other surface. It is not merely that every photographic plate used for technical measurements is individually unique, but on the plate itself there are noteworthy differences in sensitization. The silver haloid grains that are embedded in the emulsion are not all in the same state of intermolecular activity; their distribution in the emulsion is different at quite small distances apart, and the thickness of the coating is diverse in adjacent areas, it being impossible to secure

* $E_o \frac{\rho_o}{\pi}$ is entered in the table but $\frac{\rho_o}{\pi}$ is constant and equal to $\frac{0{\cdot}04}{3{\cdot}14} = {\cdot}0127$.

† H. M. Kellner, "Photographic Photometry, etc.," in the *Zeitschrift für wissenschaftliche Photographie*, XXIV, 1926–27, p. 41.

an absolute regularity when the coating is poured on the backing, as it chills at uneven rates and contracts, producing photographic reticulation of the surface.

Added to the above-mentioned uncertainties are the errors that arise during the development of the exposed silver haloid grains. An entirely uniform development is a requirement that cannot be secured, as the developer, owing to the irregular thickness of the coating, requires different time periods in which to react with the light-activated particles, and also because, in spite of the constant movement of the solution, different concentration of the chemicals is present at various parts of the coating. The errors which may result from the unevenness of the coating and the development may be considerable, and the result is of doubtful value, particularly when it is desired to compare different light sources which have an approximately similar actinic intensity.

Instead of using photographic plates for actinometry, chemical combinations, which have a sharply defined sensitivity to light, may be used, the substances that fade readily in light, as, for example, ortho-nitrobenzaldehyde in combination with pyrogallol, chinondiazide, chlorophyll, some metallic salts, or, finally, the classical mixture of chlorine and hydrogen appropriated for the Bunsen-Roscoe actinometer. The colour-absorbing materials are also available for photochemical selectivity, but only in respect to the luminous rays of the different wavelengths which are involved in their own colours. This property is also present in the coloured metallic salts and in the mixture of chlorine and hydrogen. The colourless compounds absorb short wavelength radiations with avidity.

As a consequence of this selective property these latter substances are unsuited for use as actinometers in photographic work, because for such a purpose it is necessary that the characteristic properties of the light source produces a specific effect in the material that is being used, whether asphalte, chromogelatine, iron salts, silver-loaded collodion, haloid-silver-gelatine emulsion, and other similar substances. Practical photography has consequently been compelled to adopt purely empirical methods based on operating experience with the most suitably adapted light source.

The present state of actinometry may therefore be described by saying the actinity measurements hitherto obtained have been based on obtaining, undefined, partial actinity effects which depended on the entirely casual selective absorption quality of the actinometer used, and that the photographic plate possesses the property of selective absorption. This statement also holds good for spectrographic actinometry when the blackening of a sensitized photographic plate is used as an indicator, as even with the so-called "panchromatic" plates the fundamental condition that they become black, or at least grey, for all the rays within the spectral range is not complied with, i.e., the absorption varies in different parts of the spectral range.

Accurate actinometry is only obtainable if the following conditions can be fulfilled:—

1. The selection of a suitable radiation source as a standard. This requirement is not easily fulfilled, as only heavy black bodies, at a definite temperature, comply with it, but for all practical purposes a radiating body raised to a temperature defined by its colour is a suitable substitute. From this point of view the tungsten vacuum lamp, proposed at the International Photographic Congress held in Paris in 1925, incandesced at 2,400° C. absolute, is almost welcome.

The standard light source should, undoubtedly, be contained in a quartz bulb or in one provided with a quartz window, as with glass bulbs a large range of the ray cannot be emitted, so that even at this operating temperature its ultra-violet rays can be utilized.

No great accuracy is needed in the determination of the temperature of the filament. Purely visual methods can be used for this purpose, as the ultra-violet rays do not come into consideration in measuring temperature by optical means, although they have a preponderating importance in actinometry.

The proportion of ultra-violet radiation absorbed by the incandescent lamp bulb is, however, easily determined for each temperature colour, thus enabling an ordinary incandescent lamp to be calibrated for the diminution of the rays by absorption.

2. A radiation-receiving medium which is sensitive to light that is black, or, at least from the the photochemical aspect, grey, has to be discovered in order that radiations of all wavelengths may be completely absorbed, or, alternatively, that all rays will be reflected in the same percentage proportion.

With such a medium the integrated actinity of the light source can be determined by one single measurement in a similar manner to that in which the effective optical value of a light source can be measured by the bolometer. A similar black or, photochemically, grey radiation receiver could be adapted to enable the actinicity throughout the spectrum to be measured.

It is obvious, therefore, that the many difficulties connected with actinometry do not lie in the light source but in the want of a suitable, distinct, definite, photochemical receiving medium reproduceable at any time. When the second of the above conditions has been complied with the uncertainty which surrounds actinometry at the present moment will be removed.

It must however be conceded that, in practical working, photography stands in an unfavourable position as compared with light technology, as the latter operates with only one observing element, namely, the eye, the selective absorption of which for different wavelengths has been taken cognizance of in the eye-sensitivity curve, whereas practical photography is still always compelled, with the photographic materials now available, to determine the selective absorption specially. This determination is relatively simple and has, therefore, enabled photography to attain an importance that is not inferior to that resulting from the visible utilizable effects secured in light technology, but this has produced a boundary between photography and illumination technology—a separation that has not hitherto existed between any other technical subjects. The measurements cannot be said to be more than a classification of the light sources with respect to their actinity.

The simplified equation proposed by the author, based on that of Schwarzschild, for complete actinic measurements,* is $S = it^p$, in which p is a constant ascertained for each variety of plate and for which the period of illumination t is altered by means of a sector with apertures cut so as to have different areas. Although this may introduce some error and is therefore only available for determining the order of actinity of individual light sources, the evaluations made in accordance with it in spite of this limitation are of importance, as may be gathered from the table given below, which is qualified by the reservation already mentioned. These actinity determinations were made first with a chlor-brom-silver diapositive (lantern slide plate) obtained from Hauff, of Feuerbach, and then with a Vogel-Obernett silver-eosin plate from Otto Perutz, of Munich. The relative actinities are stated on the basis of identical watt consumption required for the exposure and are therefore truly comparable.

Light Source	Relative Actinity based on the watt consumption	
	Lantern Slide	Silver-Eosin
Hefner Lamp	0·01	0·01†
Tungsten Lamp	4·7	1·68
1. Vacuum	—	—
2. Gasfilled	17·9	11·4
Open Arc Lamp		
Pure carbons	44·5	9·85
Yellow effect carbons	—	6·96
White effect carbons	—	6·02
Jupiter Lamp	175·6	13·0
Enclosed Arc Lamp		
Pure carbons	135·7	15·9
Dia-carbone (yellow)	—	18·0
Quartz Lamp	61·1	50·3

* H. Lux, "Kunstlichen Lichtquellen in der Photographie," see *Zeitschrift für Beleuchtungswesen*, XXI, 1915, Part 9, and also XXIII, 1917, Parts 13 and 14.

† The action of the Hefner lamp is 23.8 times as great on the silver-eosin as on the lantern slide plate, and therefore all the figures in the second column must be multiplied by this figure if it is desired to know approximately the time required for blackening the lantern slide with the same actinic energy as was required for the silver-eosin plate.

POPULAR & TRADE SECTION

COMPRISING

Installation Topics—Hygiene and Safety—Data for Contractors—Hints to Consumers

(The matter in this section does not form part of the official Transactions of the Illuminating Engineering Society; and is based on outside contributions.)

Luminous Ornaments

By H. LINGARD

(E.L.M.A. Lighting Service Bureau.)

ALTHOUGH perhaps the idea of a luminous ornament is almost as old as artificial light sources themselves, it is not until quite recently that lighted ornaments have acquired general popularity. Until the compactness and convenience of modern electric lamps had made possible the introduction of a luminous effect in a simple manner no noticeable progress was made in this branch of fittings design. The evolution, however, of low-wattage lamps giving a reasonable quantity of illumination has given considerable impetus to the development of such units, which can now be operated at an almost negligible cost.

The Victorian period was remarkable for the production of an enormous variety of ornaments of almost every conceivable kind, and the typical home of last century would frequently contain somewhere between

FIG. 1.—Beauty enriched by Light—A striking Luminous Ornament.

80 and 100 such decorative pieces. As a general rule, very little correlation existed between any of these ornaments, and although many of them were featured in pairs the sum total represented a vast miscellaneous collection.

Early attempts to create luminous ornaments by employing electric lamps were usually limited to the attachment of a lamp to an existing vase or similar object, producing an effect which was slightly out of the common, yet retaining the familiar form and popular features of the ordinary type of ornament.

It is common knowledge that a revolution has taken place in the decorative arts, particularly as applied to the home. This charge has been particularly noticeable during the post-war period, but it probably had its origin at a very much earlier date. This movement has in particular rooted up the old-fashioned idea of over-embellishment, so that the very advanced forms of modern residential design present to the ordinary eye an aspect which is bare and unadorned, but which possesses character in its very simplicity. From this point of view it would almost seem that the ornament is doomed to extinction. Such, however, is quite definitely not the case, for this change in the scheme of things has given the ornament a new lease of life. By the subtle introduction of light, the modern ornament is now transformed into a decorative feature of vital importance. The luminous ornament is designed to harmonize with the modern tendency in interior decoration and, generally speaking, is not an adapted form of a non-luminous piece, but is so designed that the lighting feature plays the dominant rôle.

There already exist many forms and types of luminous ornaments, and as new applications are developed this number will naturally increase. It is difficult among so many varieties to adopt any hard-and-fast system of classification, since they are obtainable in a range of types, extending from the very modern severely geometrical device, designed to add to the character of an " advanced " interior, to those luminous ornaments which serve the function of providing an amusing effect by virtue of representing some form of animal life, in literally glowing colours.

FIG. 2.—A pleasing Luminous Ornament in bronze.

With public interest recently aroused by the exhibition of two particularly modern pieces of sculpture, the

author does not wish to discuss at length the trend of modern art, but it will be generally conceded that the tendency is not so much to present the truly beautiful as to present something which will convey an impression. It is in accordance with this conception of art that the advanced type of luminous ornament which owes its form to continental influences is so strikingly unusual in design.

It will be agreed by most people that the aim of the enthusiastic householder, who takes a pride in new acquisitions, is to obtain something which is as far as possible unique, and which will arouse a jealous rivalry amongst his circle of acquaintances. From this point of view it is evident, therefore, that luminous ornaments of the most weird and inexplicable forms have considerable sales possibilities. There are, however, many people who desire to enrich a normal type of home with something really beautiful, and a number of artistic creations frequently in real or imitation bronze, incorporating luminous features, are now available. Two such ornaments are shown in the accompanying illustrations, being perfectly modelled bronzes, not too prohibitively priced, which are rendered striking by the luminous feature incorporated.

It is scarcely necessary to remark that such ornaments must be applied with restraint if the most pleasing effect is to be obtained.

As far as the illuminating engineer is concerned, the luminous ornament has not any great utilitarian value in providing illumination on any plane of work, although the exception must be made of certain modern table standards composed of luminous glass sheets, which are both efficient lighting units and which definitely come under the classification of luminous ornaments.

From the foregoing it will be seen that the greatest field at present for lighted ornaments is in the home, but there are a number of other spheres in which they can be usefully applied. Chief among these is their application for retail shops, both in the window to arouse attention and present a novel appeal, and in the interior to conform with the decorative scheme. Careful choice of these ornaments, to be in keeping with the character of the goods sold, will add considerably to their effect in increasing the sales potentialities of the modern shop, and the enterprising retailer who is always on the look-out for something which will distinguish his shop from those of his competitors will find the luminous ornament a valuable asset.

It is evident that the field for lighting features of this kind is an expanding one, and many applications come readily to mind. They can, for instance, be used with decided effect in such interiors as restaurants, cafés and dance halls, where, by their very novelty, they create the necessary atmosphere of gaiety.

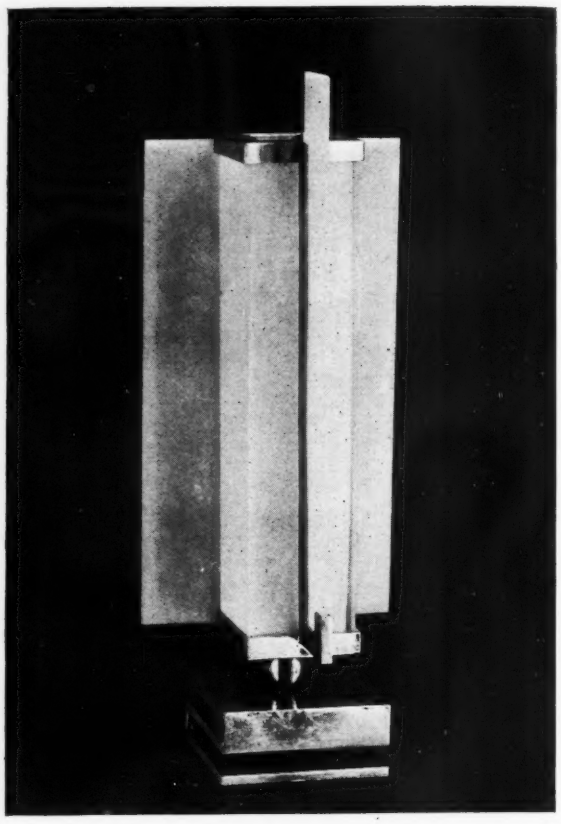
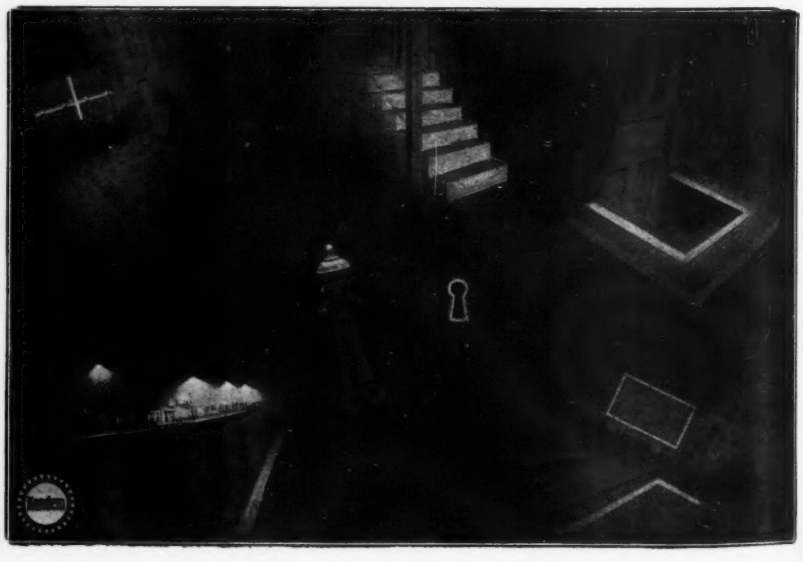


FIG. 3.—A Luminous Ornament of advanced design.

Without doubt, the illuminating engineer has in the luminous ornament secured yet another avenue for the application of his art which testifies still further to the wonderful possibilities of electric light as a decorative medium, while from a commercial point of view these devices should assist in redirecting into the channels of the lighting industry a little more of the money which is at present spent on ordinary furnishings.

The Co-operation of Others

This striking picture, for which we are indebted to the courtesy of Messrs. Korting & Mathiesen Electrical Ltd., shows how the lighting expert can receive practical aid from the consumer. Lighting units adapted to any conceivable problem may be designed, but their effect depends on the surface lighted. In order to be visible an object must "stand out" from its surroundings. It may frequently be made to do so by the skilful use of white paint or whitewash. Thus, in the picture, white borders serve to reveal the edge of a wharf and the limits of a basement staircase. A white cross on the back of a lorry and a railway truck enable them to be seen. By whitening the vertical surfaces the existence of a flight of steps is similarly revealed. Lastly, we have a very simple illustration: the outlining of a keyhole in white in order that it may be visible by the relatively feeble illumination customary in residential streets.



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Two Years of Illumination Propaganda in Austria

By HANNS KOCH (VIENNA)

THE most successful method of creating an atmosphere favourable to an increased demand for improved conditions among consumers is undoubtedly the inauguration of powerful and united propaganda. Activity of this nature must be founded on a broad basis by associating in it all organizations that have either direct or indirect interest in the achievement of the object, but the greatest factor in satisfactorily launching the movement is general confidence in its effect.

This can best be attained by making it clear to all circles involved that, whatever direction the activity takes, the advantages that accrue will not be secured by one group of persons but by everyone connected with the industry.

To disseminate the advantages which are obtained by all users of electric light who adopt correct methods of illumination is undoubtedly a community-operation which should be undertaken by all those interested in lighting economics; this, in fact, is a necessary feature in illumination propaganda.

Recognition of this obligation resulted in the foundation, early in 1927, of a central organization, "The Austrian Display Window Illuminating Propaganda," established for the purpose of explaining to Austrian business circles the meaning and the principles of correct display window illumination.

The inaugural meeting, presided over by Dr. Hans Schurff, the Federal Minister of Trade and Transport, was supported by the presence of a very large number of prominent representatives of trade, commerce and industry.

This central organization represents a co-operative working of the following bodies in spite of their diverse trade interests:—

The Association of Austrian Traders.
The Propaganda Department of the Federal Ministry of Trade and Transport.
The Chamber of Trade, Commerce and Industry.
The Austrian Illuminating Engineering Society.
The Association of Electricity Works.
The Imperial Association of Austrian Electrotechnical Concession-holding Installation Firms.
The Illumination Propaganda Association of the Incandescent Lamp Makers.
The Association of Austrian Advertising Experts.

This powerful group, which initiated the central organization on such a very broad basis, has established, in numerous towns throughout the Federated Austrian Countries, local committees of action, through which an intimate touch is maintained with the propaganda activity.

The management of the committees of action was entrusted to the local commercial organizations so as to secure the interest and the confidence of business circles, as it was believed the propaganda activities would be assisted in this manner to an extraordinary extent.

During the first two years following the establishment of the central organization of the "Austrian Display Window Illumination Propaganda," pioneering operations were successfully carried out in 19 towns, involving the illumination of 31,000 display windows, owned by 19,000 firms.

The basis of the illumination propaganda was improvement by means of light, actually and economically, of the display windows, and this was achieved by instructing everybody connected with the industry on the many advantages obtained in illumination installations in which attention was paid to the following points:—

(*a*) The existing amount of illumination.
(*b*) The glare from the light sources which caused onlookers discomfort.
(*c*) Shadow effects and the direction of incidence of the light.
(*d*) The general impression created by the display window when contrasted with its surroundings.

For classification purposes the window illumination installations were divided into three groups:—

Group 1. Satisfactory
,, 2. Fairly good
,, 3. Bad

the last being further subdivided into:—

(*a*) Capable of improvement without increase of current.
(*b*) Must be improved, but increase of current is necessary.

The actual educational activity was commenced at the beginning of September, introduced by a letter from the commercial organization to its membership, pointing out what was proposed to be done. This was supported by the committee of action, which sent a communication to various firms whose windows they suggested reporting on from the aspect of illumination, pointing out the results that might be anticipated from an individual assessment of the qualities.

By means of the information given, the trader, although a layman in this subject, was placed in the position of being able to recognize the defects in his lighting installation, and with the aid of a pamphlet, sent at the same time, entitled "The Principles of Improvement Display Window Lighting," he was able to obtain instruction respecting the possibility of a subsequent betterment that might be made on his own premises.

Simultaneously with this, educational courses, suitable for the electrical installation contractors, were instituted in order to familiarize them with the most recent advances in illumination and to give them confidence in the movement in connection with display window lighting.

Those traders who had expressed interest in the satisfactory illumination of display windows now received single-sheet pamphlets, printed in colours (eight varieties in Vienna, four varieties in the Provinces) despatched at weekly intervals, which demonstrated by illustrations and printed matter the disadvantages of an improper or insufficient display window illumination, and clearly stated the benefits that would be secured by simple and appropriate remedies.

During the period in which these pamphlets were issued, a public lecture, entitled "Correct Display Window Illumination and its Importance to the Trader," was given, the attendance at which proved the great interest taken in the subject.

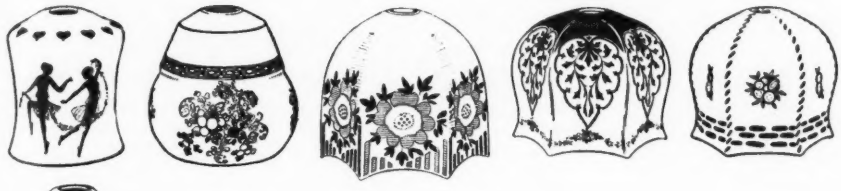
The towns of Vienna, Graz and Innsbruck at the same time inaugurated exhibitions, demonstrating correct window illumination as applied to various classes of trade, in which model display windows illustrated correct and incorrect illumination methods, as well as the influence of properly constructed show window reflectors upon the goods displayed.

The popularity of the exhibition, indicated by the large number of visitors, showed that the previous propaganda had awakened a keen desire among all classes, particularly in business circles, to obtain reliable information on lighting problems.

The propaganda campaign was concluded at the commencement of December, by a display window competition. Members of the public were requested to answer three questions and were furnished with cards, on which the questions were printed, free of charge, from the traders taking part in the competition, who indicated this fact by window tickets.

The questions were:—

1. What caused you most discomfort in a badly lighted display window?
2. Which window do you think is the best illuminated?



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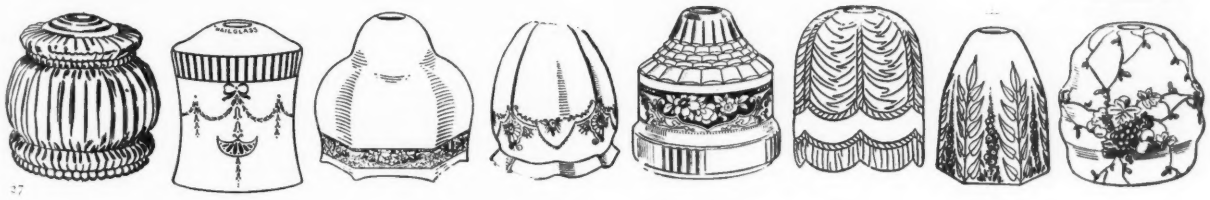

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3. What is the cost per hour of the illumination of a dwelling room, by means of a 60-watt lamp?

The object of question No. 1 was to actively interest the public in errors in display window illumination, while question No. 2 was intended to arouse the greatest possible enthusiasm of the traders in the competition, because the proprietors of the most frequently mentioned and correctly lit premises were to be awarded a diploma, and would be mentioned in the newspapers. As the questionnaire cards could be obtained free of charge only in the shops, the public were compelled to visit at least one of the premises; this fact had also an influence in encouraging traders to take part in the competition. The third question aimed at compelling users to make a simple calculation, which would prove to them how small the cost of lighting really was.

A large number of prizes were provided for distribution to those who had sent in correct answers to the questions. This also aroused widespread interest amongst the general public, as in many towns up to 30 per cent. of the cards issued were duly answered, and sent to the committee of action.

The total number of cards distributed amounted to 190,000, and the widespread support of both the daily and technical press contributed very much to the satisfactory results of the publicity activity.

There is no doubt that the steps taken in connection with this competition created a liveliness both in trade and industry, as increase of business in many directions, attributable to the movement, was confirmed by important undertakings.

The electricity supply works, as a result of this movement, benefited by a not inconsiderable increase in the demand for current for shop window lighting, and here it may be mentioned that the heightening of the peak of the load curve compared with the widening of it was quite inconsiderable, which was certainly due to the greater business activity in the installation industry, owing to the impetus given by the movement, with the result that the electrical installation contractors had been encouraged to give more intensive endeavour to the acquisition of consumers.

In addition to this, owing to the knowledge of the correct principles of display window lighting which had been imparted to business circles, innumerable improvements were made in existing installations, and it is more than probable that all the other display windows in these towns will, within a short time, be completely modified in accordance with the latest developments of illuminating engineering.

The participation of the public in the competition, which brought the special endeavour to a conclusion, directed their thoughts to the problem of appropriate illumination, thus securing a ground well prepared for a subsequent domestic lighting activity to be inaugurated.

It may therefore be affirmed that the propaganda described brings advantages both to the suppliers of electricity and to the electric industry, and that the intensive co-operative working of all the concerns which have an interest in the industry secures increased demand for current, particularly during the evening and night hours, and serves as a noteworthy pioneer effort.

The following figures in Table I show the results achieved in the improvements of display window lighting in the towns of Graz, Linz and Innsbruck.

The city of Innsbruck made a return in which the display windows were classified, as at the commencement, into 16 definite trades and one group of miscellaneous ones. This showed that before the campaign was inaugurated the order of demerit was: flower shops all in class 36, followed closely by boots and shoes, perfumery, hairdressing, furniture, and tobacco shops, in none of which branches was there a first-class installation. The initial small amount of second-grade illumination, compared to the immense amount of the third variety, is indicated in the tabular matter, and the change *after* propaganda in this city illustrates its educational value.

TABLE I.—RESULTS OF THE ILLUMINATION PROPAGANDA CAMPAIGN.

Town and Classification Number	Display Windows Assessed			
	Before		After	
Graz	Number	Percentage	Number	Percentage
1	3	0·13	106	4·54
2	111	4·93	169	7·23
3a	469	20·82	871	37·27
3b	1,669	74·12	1,191	50·96
	2,252	100·00	2,337	100·00
Linz				
1	34	4·9	172	24·72
2	84	11·8	136	19·43
3a	69	9·9	100	14·14
3b	513	73·4	292	41·71
	700	100·0	700	100·00
Innsbruck				
1	0	0·0	229	15·0
2	33	2·2	86	5·6
3a	122	8·1	237	15·4
3b	1,353	89·7	978	64·0
	1,500	100·0	1,530	100·0

In pursuance of their programme, the central organization for Austrian display window illumination propaganda instituted in Vienna, last September, an instructional course for the employees of the Austrian electricity works, in order to impart information to them respecting the most recent advances in the fields of illumination technology and lighting economics and to prepare the ground for carrying out, during the current year, propaganda chiefly dealing with showrooms and the illumination of name and designation plates and also, to a limited extent, domestic lighting problems.

The active participation, in this course, of all the electricity works of the Federated Austrian Countries demonstrates that the co-operative work has proved of the greatest interest, and that a very large number of the central stations are prepared both to support and to spread to the fullest extent any pioneering activity intended to demonstrate the economics of proper light utilization.

Mr. M. J. Railing

Appointment as Joint Managing Director of the General Electric Co. Ltd.

An interesting announcement at the recent annual meeting of the General Electric Co. Ltd. was made by Sir Hugo Hirst, who invited Mr. M. J. Railing to become joint managing director with him. The proposal was received with enthusiasm, and was unanimously endorsed by the meeting, which thus showed its appreciation of Mr. Railing's services to the Company, and especially of the efficient way in which he had conducted its affairs during Sir Hugo's recent absence in Australia.

Mr. Railing has served over 38 years with the Company, and has been general manager for 18 years. During his period of service he has seen the Company's capital multiplied by 100 and its employees multiplied by an even larger figure. Many new branches have been opened and works acquired, and we may mention one especially noteworthy event, the establishment of the Research Laboratory at Wembley, which, under the guidance of Mr. C. C. Paterson, has contributed very largely to the technical success of the Company.

Mr. Railing, it is generally agreed, possesses the qualifications that this important post demands, and in taking up his duties he will receive the wholehearted support of the staff of the G.E.C. and the good wishes of his many friends in the electrical industry.

The Lighting of the New Council Buildings, Nottingham

A NEW stage in the history of the city of Nottingham was reached on May 25th, when the new Council House and Exchange were opened by H.R.H. the Prince of Wales. The new buildings are situated in the spacious market square, associated with stirring events in history which go back 1,000 years. There are probably few buldings outside London having an equally good central position and approach.

The lighting arrangements throughout the building afford a good example of close co-operation between the architect, the decorative craftsman and the illuminating engineer. A feature of the marbled entrance hall on the ground floor is the large dome. Lamps in reflectors are sunk in an invisible cornice running round its base. This cornice lighting is, however, supplemented by a series of floodlights which direct rays through the series of 24 windows in the dome, all fitted with special amber-tinted glass which is graded in depth as one passes from the base of the dome to the apex.

In the members' room and library the walls are panelled in dark oak and the coffered ceiling is finished in a delicate cream tint. Light is afforded from 385 Osram lamps in a series of concealed trough reflectors, which afford a shadowless glow throughout the entire room.

FIG. 1.—The Council Chamber.

In the Council Chamber (Fig. 1), which is semi-circular in shape, special attention was devoted to the lighting and the acoustics. In order to obtain complete freedom from extraneous noises the floor is heavily carpeted and the panels are made of thickly padded quilt, exactly matching the colour of the woodwork so that at first sight the two materials are indistinguishable. The ceiling shows a series of graduated panels culminating in a large semi-circular lay-light, through which daylight is admitted to the room. 224 " Geco-Ray " reflectors each containing a Pearl Osram lamp, are disposed along the whole length of the semi-circular cornice concealed behind the top of the panelling. An interesting detail in design is the cone finish to the ceiling next to the walls —a device which is a great aid to diffused uniform illumination.

In the dining room, Fig. 2, with a barrel ceiling in light tints, concealed lighting is again introduced, a feature being the delicate suggestion of pink that is given to the lighting by the colouring of the plaster work.

Perhaps one of the most spectacular effects in the building is the floodlighting of " Exchange Row," the name given to the massive arcade which runs between the two wings at the rear of the main front block. This new shopping way, which is seen in Fig. 3, is of unusually lofty dimensions. The barrel roofs are 60 ft. high and at their intersection from the main dome feature with an inner dome rising 90 feet above the pavement. This arcade has already been let for high-class shops, which are faced in Bath marble bases, the shop fronts being in bronze. The interior illumination of the windows will serve to supplement the ingenious floodlighting by means of " Geco-Ray " reflectors concealed behind the tall Greek vases arranged on each side of the arcade along the projecting masonry of the shop fascias. This floodlighting is deliberately made somewhat subdued, so as not to compete with the higher brilliancy to be attained in the shop windows. Special lighting is, however, applied to bring out the colouring of the four frescoes painted by Mr. W. Denholm Davies which adorn the entablature between the four supporting arches of the dome.

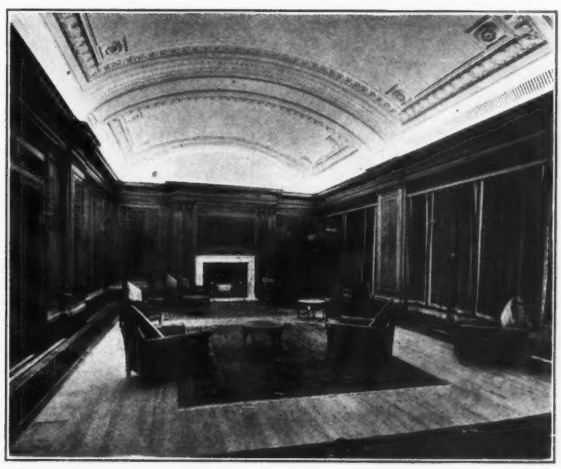


FIG. 2.—The Banqueting Hall used as a reception room when arranged as shown above.

This fine public building, one of the largest in the country, possesses many distinctive features. It is gratifying to note that in this case lighting worthy of the interior has been provided. The good results attained are due to the joint efforts of the architect, Mr. T. Cecil Howitt, and the Illuminating Engineering Department of the General Electric Co. Ltd. The whole of the electrical installation was carried out by Messrs. W. J. Furse & Co., of Nottingham.

FIG. 3.—Exchange Row, the new shopping way.

The Lighting of Sheffield

(The following extracts are taken from a speech delivered by Mr. J. F. Colquhoun, Lighting Engineer to the Sheffield Corporation, before the Sheffield Rotary Club on June 17th, 1929.)

THE cost of street lighting in Sheffield for the year ended 31st March last was £61,730. This figure includes the capital cost of new lamps, automatic clock controllers, time switches, etc., in addition to the maintenance of the existing lamps. It is slightly more than ½d. per week per head of the population. To be more exact it is 2s. 4¼d. per head per annum.

Leeds pays 4s. 5d. per head per annum; Manchester pays 3s. 6d. What do we get for that expenditure? 2,030,000 candle-power for 3,650 hours per annum. 2,030,000 the total candle-power for all the lamps, and 3,650 the total burning hours per annum. Good value for 2s. 4¼d.

And how is it done? There is an army of 36,090 gas mantles on duty each night in 14,744 gas lamps. The small inverted mantles now used are sturdy little fellows, with an average life of 150 days as compared with the 28 days of the upright mantles formerly used. They give an average of 1,460 burning hours, as compared with the 1,000 burning hours of the modern electric lamp.

Each lamplighter is told monthly what the consumption of mantles has been on the lamps under his charge as compared with the average over the whole city. We have been doing this for two years now, and it has had a marked effect in promoting carefulness in handling. And this without loss in the efficiency of the lighting. Indeed it is found that the men who use the least number of mantles have the best-kept lamps. The small consumption of mantles is merely symptomatic of the greater carefulness and greater efficiency of the men.

With hand lighting a man lights, extinguishes, cleans and fully maintains 120 gas lamps. With the aid of clock controllers he looks after, *as a minimum*, 200 gas lamps. The automatic controller is quite a clever piece of clockwork apparatus. The system has its advantages and its disadvantages. It is cheaper than hand control. The lamps are lighted up more or less simultaneously. It takes no account of varying climatic conditions. These conditions vary more than one would suppose. During the early days of May *this year* the street-lighting service was necessary fully half an hour before it was necessary during the same days of last year. With automatic control it is very difficult to accommodate the lighting service to these variations. But on the whole the system is satisfactory, i.e., the advantages outweigh the disadvantages, and the automatic control of gas lamps is likely to extend.

Each hour the gas lamps are in use we burn £3 3s. 2d. worth of gas, and Sheffield gas for street-lighting purposes is very cheap. The Lighting Department loves the Gas Company when they reduce the price of gas, because 1d. reduction per 1,000 cubic feet means a reduction, on our present gas consumption, of £1,000 per annum in the Lighting Department expenditure. An increase of 1d. means. . . . , but an increase in the price is not to be thought of.

In addition to the gas lamps, we have now a goodly number of electric lamps in the street-lighting service. There are 2,747, varying in size from 60 watts to 1,000 watts. Almost all these are controlled by time switches. Each switch on the new housing estates controls 40 to 80 lamps, and in the main street lighting installations 12 lamps. The Electric Supply Department now incorporate, in all new cables laid, a special wire for street-lighting purposes, and the system works well. . . . .

Sheffield is a particularly difficult place to light because of its dark buildings. Consider what a difference there would be if all the buildings in a street were white, like the *Telegraph* Buildings or Newsholme's. Any given standard of visibility in that street, as compared with the normal Sheffield street, could be obtained at much less expenditure of gas or electricity used in the street lamps.

The reflecting properties of different road surfaces affect the problem also. Atmospheric conditions have a bearing on the subject. Another factor which reduces the effectiveness of street lighting is the use of glaring headlights of motor vehicles in city streets.

I had the honour of attending the meeting of the International Commission on Illumination in America in September last, and the delegates from other countries were much surprised to learn that glaring headlights were permitted in the towns and cities of Great Britain. Since July, 1923, the use of headlights, where there is a street-lighting service, has been prohibited in France by the "Code de la route." . . . . . There is a law against their use in New York City, and offenders are liable to punishment. The same thing applies to the whole of Switzerland. Headlights are strictly forbidden in Vienna. . . . .

There has been considerable activity in the lighting of Sheffield during the past five years, and you may be interested in hearing what has been done.

The number of gas lamps in use has increased from 11,112 to 14,744 and the electric lamps from 287 to 2,747—an increase of 6,092 lamps, or 53 per cent. over the 1924 figures. The illumination, however, has been increased fourfold, i.e., from 500,000 to over 2,000,000, and the time during which the lamps are lighted has been increased by 113 hours.

Now 17,491 lamps is a fairly large family to look after, scattered as they are over an area of 32,000 acres, and 30 to 60 yards apart. Therefore the city is divided into 104 small districts, with a lamplighter responsible for each district. There are also four surveyors constantly inspecting the lighting and reporting faults. The street-lighting plant has been completely overhauled during the past five years, 7,780 gas lanterns have been remodelled in our own workshops and 4,500 new copper lanterns have replaced a like number of old lanterns which were beyond repair.

We have purchased and installed 5,576 clock controllers for gas lamps, and time switches to control 2,594 electric lamps are now fitted.

Two years ago the Lighting Committee decided to light all courts which form the only access to two or more houses. There are over 2,000 such courts in the city, and we have now 1,362 lighted. It is very necessary that these places should be lighted. Some of them form the only access to as many as 20 houses, and they were in complete darkness at night.

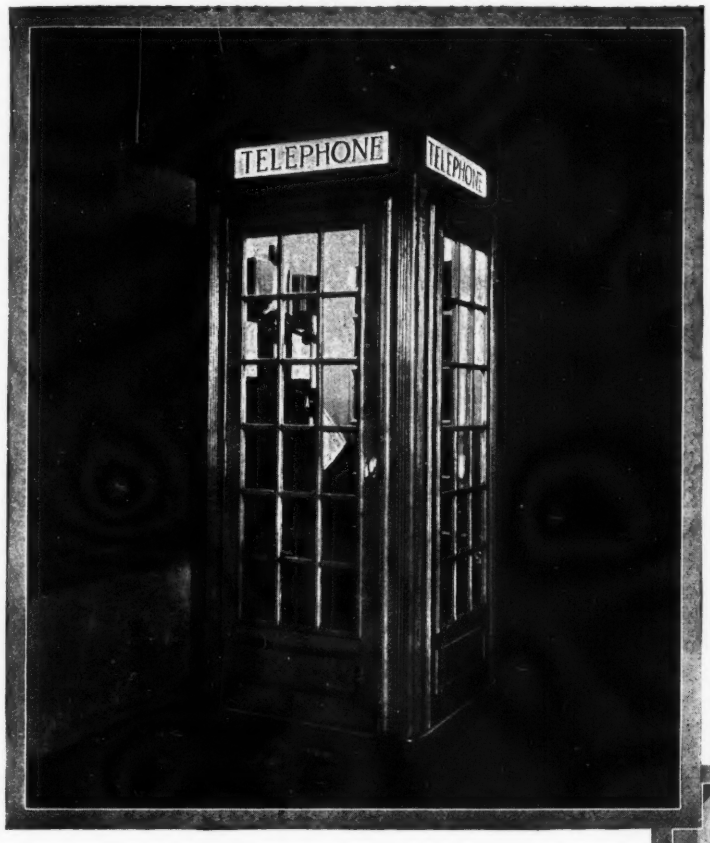
Street lighting is now receiving much more attention than formerly; this attention is much overdue. The enormous increase in motor traffic has forced consideration. The subject undoubtedly received the greatest attention at the meetings of the recent International Commission on Illumination. It is recognized that of all illumination problems street lighting is the most difficult. As I have said, modern conditions of traffic require quite a different street-lighting service. The speed of safe travel is largely the speed of vision, and while things have greatly improved over the whole country during the past few years we have still a long way to go to reach our objective, namely, that so far as lighting is concerned travelling in towns and cities between dusk and dawn shall be as safe and comfortable as travelling between dawn and dusk without the use of headlights.

INCANDESCENT MANTLES

A large foreign consumer of gas mantles seeks connection with a dependable non-trust manufacturer, who produces silk and ramie fibre mantles. Write to 500,000/1929, c/o. Rudolf Mosse, Vaci utca, 18, Budapest IV, Hungary.

The Lighting and Ventilation of Telephone Kiosks

(*Communicated.*)

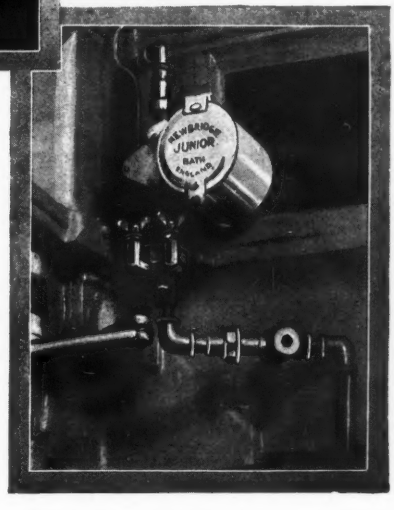


PUBLIC telephone kiosks have now been installed extensively in our streets, available for use throughout the 24 hours of the day, and special attention has therefore been given to their interior lighting.

The illustration on the left shows one of the standard types of kiosk of metal construction as fitted in the City of London and throughout the West End. There are no attendants at these kiosks, and means have therefore to be provided for the automatic lighting-up and extinguishing of the illuminant.

The telephone box shown is illuminated at night by gas. The lighting unit is a specially-designed incandescent burner of medium size. This is fixed in the dome of the structure, with its mantle in the centre of a circular opening cut in the roof. A silica-ware globe, protected by wire guard, diffuses and softens the light. This globe is fitted to an independent hinged carrier so arranged that it can be opened easily to give access to the mantle and to allow of the removal of the globe for cleaning. The intake of air and the exit for the products of combustion are provided for by openings made in the "Crown" device in each of the four sides of the dome. The slight heat given out by the burners in the new kiosks is a distinct advantage, as it has a valuable ventilating effect. The gas consumed in the kiosks is not registered by meter, but is calculated in the same manner as is the gas consumed in street lamps; that is to say, by multiplying the number of hours per annum the burner is in use by the hourly consumption of the gas burner. The burners and mantles in these kiosks are periodically inspected and kept in good condition by the gas undertakings.

The lower illustration shows the simple controller operated by clockwork which automatically turns the light on and off at the usual times fixed for street lamps. In the outlying districts of London concrete telephone boxes are being erected. For those which are lighted by gas a lighting unit of slightly different pattern from the one described has been designed.



Lighting and Cooking at the North-East Coast Exhibition

At the North-East Coast Exhibition a good deal of the lighting is done by gas. It is being used for lighting the roads leading to and in the Amusement Park. In the Amusement Park itself there are 17 standards, each having three five-cluster burner lamps. These lamps provide an illumination of 1,500 candles per standard, i.e., a total of 25,500 candle-power.

Gas is used in the Motor Park. There are four standards each with three five-burner gas lamps, giving a total illumination of 6,000 candles.

One of the main cafés is also lighted by gas lamps of a total candle-power of 21,000, with distance controls.

To feed the hungry at the North-East Coast Exhibition is no mean task. The authorities say that they expect between four and five million visitors during the five months that the Exhibition is open. Judging by the numbers who have visited it during its first few weeks, this is by no means an exaggerated estimate.

A week or two ago the million mark was reached in attendance, and during Newcastle Race Week, the great northern holiday, the figures rose beyond all expectations. On the opening day the numbers reached the astounding figure of 75,000.

This means that on the average about 30,000 people daily have to be provided with some sort of refreshment —from a quick snack at a bar to a lordly dinner in the Garden Club. It is interesting to learn that gas is being used for the whole of the cooking and water-heating for these huge numbers.

TO TEST STREET LIGHTING FOR CONFORMITY WITH THE BRITISH STANDARD SPECIFICATION

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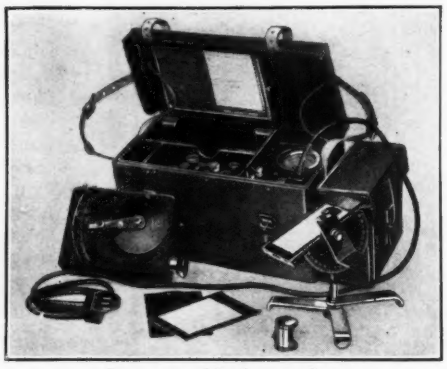
RANGE "A" LUMETER has been specially designed with a long low reading scale for street lighting tests.

This instrument has a direct scale of 0 to 0·2 foot-candles and a secondary scale up to 2·0 foot-candles without the use of neutral filters.



Lumeter with Accessories.

RANGE "B" LUMETER is designed for higher illumination values as found in interior lighting.

The direct scale is from 0 to 20·0 foot-candles and by the use of neutral filters illumination values up to 2,000 foot-candles can be measured.

For particulars apply to :

Holophane Ltd. 70, Elverton Street Vincent Square, **London, S.W.1**

Telegrams : "HOLOPHANE, SOWEST, LONDON." *Telephones:* VICTORIA **8062, 3 lines.**

HOLOPHANE SALES CONFERENCE.

The annual Holophane Sales Conference, held during July 10th and 11th, which was attended by a considerable number of provincial representatives, was an interesting event. A brief opening address was given by Mr. J. Hepworth Thompson, managing director, after which Mr. J. S. Dow (Hon. Secretary of the Illuminating Engineering Society), who had been invited to attend, made a few remarks emphasizing the rapid way in which illuminating engineering was developing at home and abroad.

An able address by Mr. Dean on "Sales Policy" followed, after which Mr. E. Stroud gave an account of progress, in the course of which some enterprising new departures were mentioned. New types of units are being introduced for street lighting, show-window lighting, and general interior lighting. Special attention has been paid to the design of floodlighting units for close work, and large parabolic units, fitted with "Pyrex" heat-resisting glasses, are now available; these are made with three types of front lenses : (1) in stippled glass, (2) with concentric slightly spreading prisms, and (3) with vertical spreading prisms. Other novelties include a new line of artificial-daylight units, which are believed to be exceptionally efficient, the Holophane prismatic glass panels, which may have applications for lighting hospital operating theatres and for certain types of shop interiors, and an "egg candler"—an ingenious device for testing eggs, capable of producing 10,000 foot-candles at the aperture to which the egg is applied. We hope later to give some further account of some of these novelties.

Other features in the programme included an address by Dr. English on "Holophane Glass," in the course of which some of the points dealt with in the author's recent address before the Illuminating Engineering Society were illustrated; a talk on industrial lighting by Mr. L. M. Tye; and a demonstration of colour lighting by Mr. R. Gillespie Williams. During the conference Mr. W. J. Jones also gave an outline of the campaign now being pursued by the E.L.M.A. in connection with pearl (internally frosted) lamps, the general adoption of which would not only do much to minimize glare but would aid lamp manufacturers considerably in effecting standardization.

The various addresses were actively discussed by those present, who showed a keen interest in the various new appliances on view. At the conclusion of the conference those participating availed themselves of an invitation from Mr. Thompson to visit his charming residence at Magna Carta Island.

THE NEW EMBANKMENT LIGHTING.

The first section of the new Thames Embankment lighting, comprising five spans of 140 feet, commencing at the House of Commons, was switched on by Sir George Humphreys, K.B.E., Chief Engineer to the London County Council, on June 29th. It will be recalled that the system consists of 1,500-watt gasfilled lamps in Wembley lanterns, suspended in pairs along the roadway, 30 feet above ground level. The full scheme from Westminster to Blackfriars will doubtless be finished by the General Electric Co. Ltd. in the near future, and the completion of the scheme will be awaited with general interest.

A FLAME-PROOF HAND LAMP.

A distinct departure from the standard practice in the design of hand lamps is shown in the new "Wigan" flame-proof hand lamp, manufactured by Heyes & Co. Ltd., Wigan, an illustration of which is depicted on page xi. It has been primarily designed to provide a portable unit for inspection purposes, etc., where explosive atmospheres are liable to occur. It has been tested and approved by Sheffield University for flame-proof enclosures in pentane-air and acetone-air mixtures forming the subject of Report No. 254. The maximum size of lamp that it will accommodate is a 25-watt gasfilled type, and radiating fins are incorporated to assist in the quick dissemination of the heat. The temperature rise, however, is very small, being only 130° F. after five hours burning, attaining this maximum temperature in approximately two hours, with an initial room temperature of 74° F. A substantial welded-wire guard with a flat base is fitted, and also a joint box to facilitate wiring and to isolate the well-glass portion. Being constructed of aluminium alloy, its net weight is only 4½ lbs.

The manufacturers will be pleased to forward further particulars to anyone interested.

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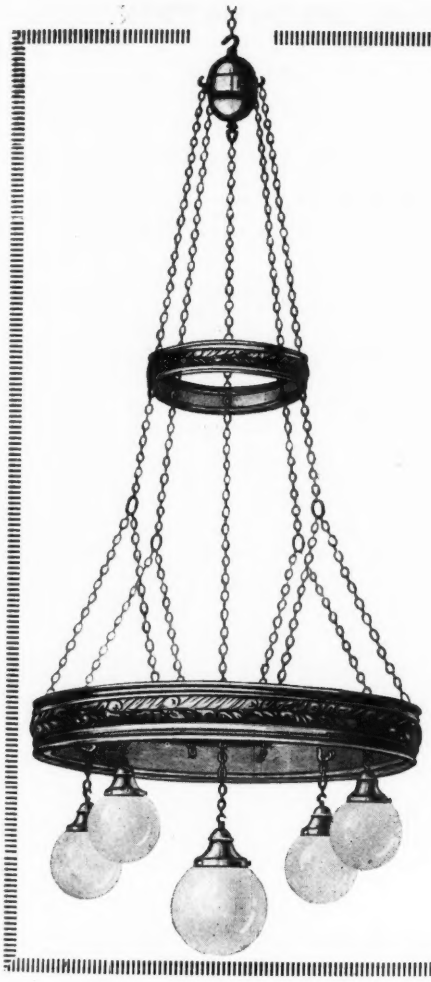
Royal Mail Steam Packet Co.; for the supply of metal-filament and carbon-filament lamps during a period of 12 months.



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SINCE the year 1909, when the Illuminating Engineering Society was founded in London, it has been the official organ of the Society.

IT is *the only journal in this country exclusively devoted to Lighting by all Illuminants.*

IT receives the assistance of contributors who are leading experts on illumination in this country and abroad. Foreign Notes and News will be a speciality, and correspondents have been appointed in all the chief cities of the world.

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Good Lighting is of interest to everyone. The Journal is read by engineers, architects, medical men, factory inspectors, managers of factories, educational authorities, public lighting authorities, and large users of light of all kinds.

BESIDES being issued to all members of the Illuminating Engineering Society, the Journal has an independent circulation amongst people interested in lighting in all parts of the world. The new and extended form of the Journal should result in a continual and rapid increase in circulation.

Every reader of THE ILLUMINATING ENGINEER, the Journal of GOOD LIGHTING, *is interested in illumination, and is a possible purchaser of lamps and lighting appliances. Gas and Electricity Supply Undertakings likewise benefit by the movement for Better Lighting, with which the Journal is associated, and which stimulates the demand for all illuminants.*

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The Illuminating Engineering Society.

Monthly meetings are held, at which interesting papers are read, and discussions on such subjects as the lighting of streets, factories, schools, libraries, shops, etc., and exhibits of new lamps and lighting appliances take place.

Members receive *The Illuminating Engineer*, the official organ of the Society, free.

The Society preserves an impartial platform for the discussion of all illuminants, and invites the co-operation both of experts on illumination and users of light; it includes amongst its members manufacturers, representatives of gas and electric supply companies, architects, medical men, factory inspectors, municipal officers, and many others interested in the use of light in the service of mankind.

The Centre for Information on Illumination.

For particulars apply to:

J. STEWART DOW, *Hon. Secretary*,
32, Victoria Street, LONDON, S.W. 1.